DECEMBER 3, 1938

ELECTRICAL WORLD

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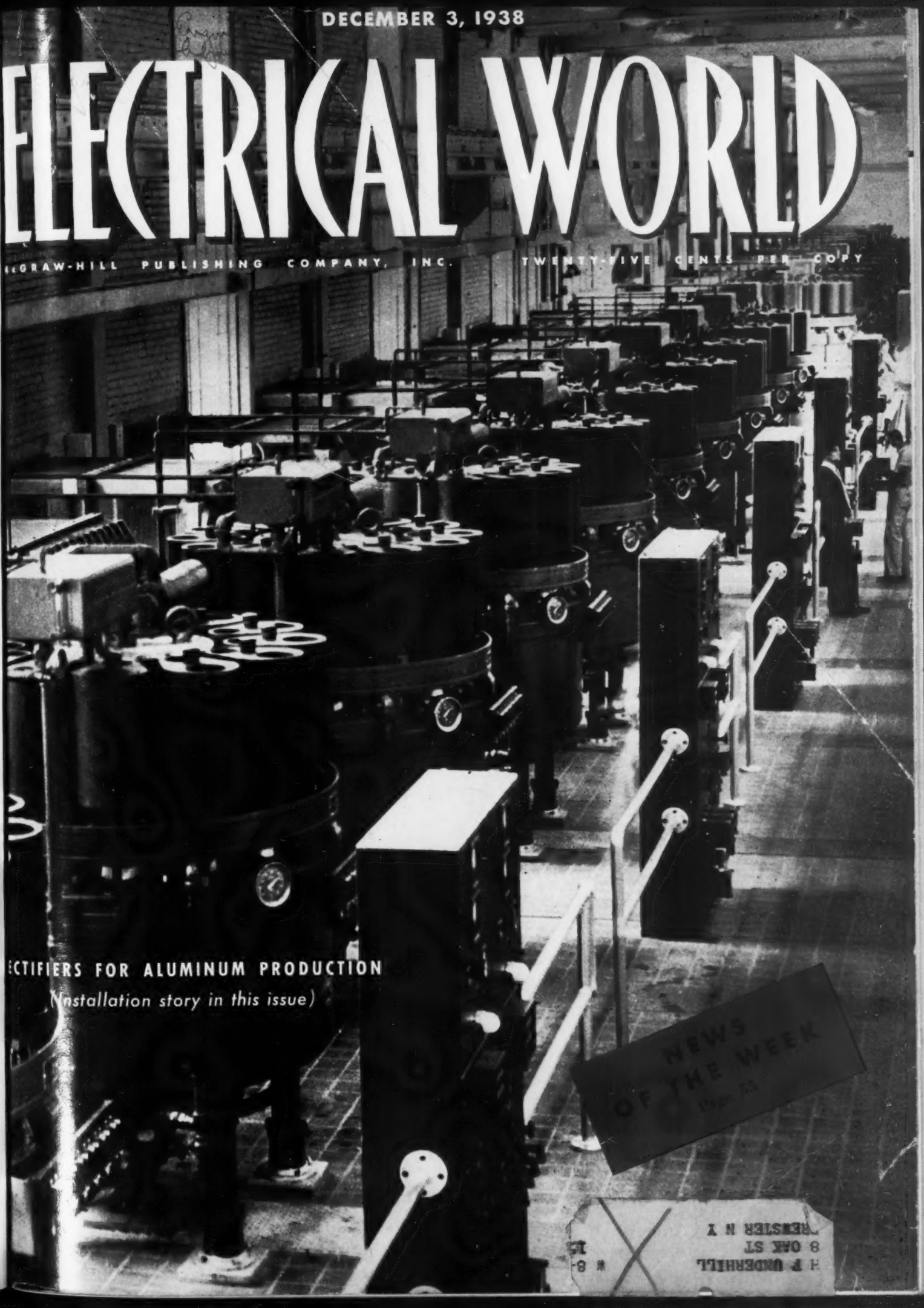

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(Installation story in this issue)

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OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

Letters TO THE EDITOR

Holds to Paper's Conclusions

To the Editor of ELECTRICAL WORLD:

The following replies to D. H. Tuck's letter (see ELECTRICAL WORLD, November 19, 1938, page 33) commenting on my paper on "Control Room Lighting," which appeared in the October 8 issue.

Adequately designed indirect lighting systems for control rooms, where proper co-ordination is maintained between ceiling reflection factor and the intensity on the instruments, will not produce any noticeable instrument glare. If all surfaces in the room are finished in lighter colors no objectionable contrasts will exist between switchboards and walls and ceilings.

Excellent results are obtained with artificial skylights in rooms with reasonably high ceilings, but the cost of such installations is often prohibitive and maintenance is more complicated and more expensive than with indirect systems. Direct light sources concentrated in small areas as proposed by Mr. Tuck can be made effective in some cases, but in most control rooms, where many switchboards are arranged in angular or circular configurations, the reflection of the direct sources in the instrument faces becomes a problem.

It should not be said that "Polaroid definitely will not help" until its possibilities have been fully investigated, because experiments have indicated that it may have promise. Tests have shown that all trace of reflected light can be eliminated from the glass instrument faces by equipping the direct light sources with Polaroid glass and furnishing the operator with Polaroid glasses. This method is not very practical, of course, but it does indicate that Polaroid should not be discarded without fully considering its possibilities.

Mercury vapor in a 1 to 2 ratio combination with incandescent units does offer one practical solution to the lighting problem, as evidenced by many such installations giving satisfactory service. As an example, one control room has been modernized with fourteen combination 250-watt mercury and 500-watt incandescent units installed in existing outlets. Instrument glare is almost unnoticeable. This room, with a total wattage of 10,500 (0.4 watt per sq.ft.) producing an intensity of 28 ft.-candles, is exactly the size of the one designed with the artificial skylight in Fig. 6 of my paper referred to by Mr. Tuck, which has a total of 22,000 watts (0.8 per sq.ft.) producing 35 ft.-candle intensity. Not all of the gain in efficiency is lost in the combination and the advantage of the softer, more pleasing light of the mercury spectrum is retained.

I do not agree that art gallery lighting is at all comparable to control room lighting. The problem in art gallery lighting is only that of providing illumination on the flat vertical surfaces of paintings on the four walls of a high-ceiling room. The occupants are transients, concerned only with visual acuity of the paintings from a distance, with no problem of continued eye fatigue involved. In the control room are switchboards in various shapes and configurations with a variety of vertical observation levels on each panel. In addition, there are other complications, such as desks and telephone switchboards, and the operator must, for seven or eight hours each day, view the instruments from various locations throughout the room, and he must also regularly record instrument readings in these various locations.

I am not familiar with the Chicago and Wilmington Art Galleries, but Mr. Tuck has been misinformed when he states that the Philadelphia Art Museum abandoned the totally indirect lighting principle and the artificial skylight. On the contrary, many sections of the museum have either totally indirect lighting or artificial skylights or a combination of both. As a matter of fact, the two rooms acclaimed as the best lighting in the institution are the French Cloister and the Romanesque Court, each equipped with a totally indirect system only. The Rotunda, another room popular because of its excellent lighting, has a combination of an artificial skylight at the top of the dome, with the remainder of the ceiling equipped with indirect lighting.

It might also be mentioned that practically all painting backgrounds in this museum are either buff, cream, or white, although this bears no relation to the switchboard painting problem.

Any light color is superior to black for switchboard finishes, but we have favored the aluminum gray because of its many advantages, such as absence of glare, ease of cleaning, simplicity in matching or touching up, and reduction in contrast with light walls and ceilings.

W. B. MORTON,
Philadelphia Electric Company.

To the Editor of ELECTRICAL WORLD:

In the fifth paragraph of Mr. Morton's letter he states that combination mercury units with 0.4 watt per square foot gives 28 ft.-candles. As I figure this job, assuming 100 per cent efficiency of the reflector equipment and 100 per cent utilization efficiency, the the illumination would be 9.35 ft.-candles.

DAVIS H. TUCK.

To the Editor of ELECTRICAL WORLD:

The confusion concerning the 28 ft.-candle intensity obtained with the combination mercury unit is understandable because of a typographical error in my letter. The 0.4 watt given for the combination mercury unit should have been 4 watts and the 0.8 watt given for the skylight job should have been 8 watts. This would have been evident by plain arithmetic if I had given the room size for each job, which is approximately 80 ft. x 32 ft.

I believe this clears up the apparent discrepancy.

W. B. MORTON.

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Reaches Crews With 39.66 Mc.

To the Editor of ELECTRICAL WORLD:

In the ELECTRICAL WORLD (page 51) October 22, 1938, news report of my paper at the E.E.I. committee meetings it was not made clear that the 3,190-kc. stations of the Detroit Edison Company operate strictly as point to point stations. The radio dispatching of trouble crews is handled in the ultra-high-frequency band (30-42 mc.). Station WQJL, which is licensed as a special emergency station, operates on a frequency of 39.66 mc. We have made no attempt to use the medium-high-frequency transmitters (3,190 kc.) in this work.

JOHN W. DRUMMOND,
Asst. to Superintendent Overhead Lines, Detroit Edison Company.

"WE LIKE YOUR NEW REGULATOR, GENERAL ELECTRIC"

"WE have always preferred the induction principle for feeder-voltage regulators, and now you enable us to use it with greater economy."

Other comments coming in from users of our new induction regulator for station or branch service are equally favorable:

1. "We like the idea of *one* design for use indoors or out."

2. "We have always found that when a product looks right it's usually built right. Your regulator is the best looking and most practically designed unit we have seen."

3. "It's a real advantage to be able to install it without auxiliary or interconnecting wiring on single- and three-phase circuits."

4. "We like the dynamic braking and the self-contained motor and control supply."

Summed up, these and many other favorable comments support our original announcement that this new regulator would give you lower installed costs, reduced maintenance, and greater flexibility of application. Be sure to investigate this design before buying new regulators. For complete information, ask for Bulletin GEA-2985. General Electric Company, Schenectady, N. Y.

NOTE

This new induction regulator supersedes the standard G-E outdoor and indoor types, in ratings of 36, 48, 60, and 72 kva single-phase, 60 cycles, 2400 volts and 4800 volts.

GENERAL ELECTRIC

350-141

ELECTRICAL WORLD

DECEMBER 3, 1938

The Tax Dilemma

Tax officials attending the recent annual conference in Detroit of tax administrators were reported as expressing considerable concern over the loss of city, county and state revenues as the result of increasing public ownership of utilities. This is one of those realities which government ownership advocates have refused to acknowledge when plans are being made, but which sooner or later must be faced.

The people were told that public ownership would bring lower rates, but they were not told by the politicians, nor vividly enough by the utilities, the extent to which the difference in rates between those charged by the company and those proposed by the city would be offset by the loss in tax receipts. Nor was the public told how the loss in taxes was to be made up. True, it was intimated that rates under public ownership, though lower, would return enough profit to more than compensate the public for making the move, but the difference between promise and performance is the terrible reality of the latter.

The suggestion now is that the lost revenue be made up by a compensating tax on the sale of electric energy from the publicly owned utility systems. While this would seem to be the obvious procedure, what is the public gain?

Knowledge of this situation, if widespread, might do much to dampen enthusiasm not only on the part of the public, but of local officials as well, for any change from private utility operation. Political administrators take no delight in levying higher taxes on voters.

At the same time, the public should be warned that private ownership cannot continue to pay steadily increasing taxes without finding relief. There seems to be a tendency on the part of some regulatory bodies in this connection to ignore the rules of simple arithmetic.

So far the utilities have on the whole been able to absorb rate cuts and higher taxes without seriously curtailing the return through the exercise of rigid economy and of refinancing to reduce fixed charges. To both of these, however, there is a limit.

While every week we report new instances of rate reductions, it must be obvious that the period of rate cutting is bound to come to an end, and that before long. In fact, the question of the moment is how to place the increasing cost burden, principally taxes, upon the customer's bill.

On contract business, for instance, what shall be the policy? Shall long-term contracts be taken, and, if so, should they contain tax clauses? Or should the policy be to take only one-year contracts? Already a number of companies have included tax clauses in their municipal street lighting contracts.

The tendency to make tax collectors out of the utilities is still strong. The need for more public revenues is growing all the time. Utilities will continue to pay higher and higher taxes until such time as the public understands that the power company is not paying those taxes out of its own pocket, but is merely acting as a tax collector.

Taxes, which in some instances run as high as 27 per cent of gross revenue, present a dilemma to the utilities. High taxes can be a deterrent to public ownership, but in so doing the utility may be forced to scrape in every way to maintain low rates. And as taxes advance, it becomes more and more difficult to live within the rates. So what to do?

Since to complain is futile, may not this tax liability be turned into an asset? The liquor industry played up its rôle of tax collector and secured repeal, but the customer knew who in reality was paying the bill. Perhaps the utilities can make capital of their function as tax collectors through itemization of taxes on the bills or other customer education.

Transformer Simplified by Magnetic Research

Spiral Core Design Realizes Gains in Material and Efficiency From With-Grain Use of Cold-Rolled Strip

By A. BOYAJIAN
General Electric Company, Pittsfield, Mass.

TRANSFORMERS have long been known as among the most efficient and perfected of electrical equipments, but the research for still better materials and methods never ends, and one of the most recent contributions of such research has been the successful utilization of the remarkable magnetic properties of electrical "strip" by means of a new transformer construction of striking efficiency and simplicity.

The march of progress in the reduction of the losses of the commercial silicon sheets for transformers, from around 1900 to date, is conveyed vividly in Fig. 1—a reduction of about 3.5 to 1. The fact that reductions have been at first in large steps and later in diminishing steps gives a semblance of saturation of research, with a slow asymptotic approach to a goal which is not materially higher than the present accomplishment, but the subject matter of this narrative indicates how research brings about improvements in unexpected ways.

Magnetic "strip" is a medium-silicon alloy of steel manufactured as a continuous ribbon in large rolls, as contrasted with the ordinary magnetic "sheets" which are of high silicon

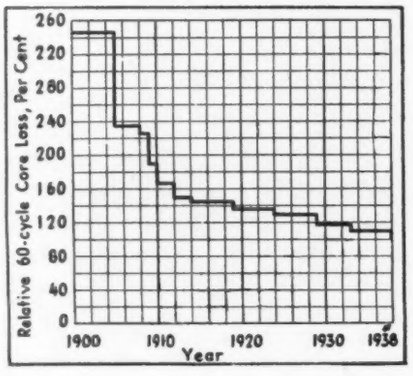


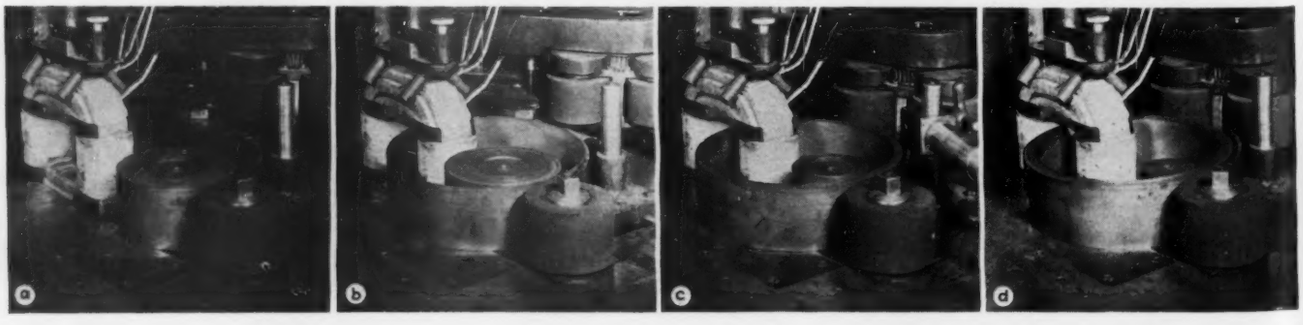
Fig. 1—Core losses 3½ times as great 38 years ago

content (4.5 per cent) and are manufactured in the standard, 3 x 9-ft., size. "Strip" is rolled cold, with high reduction. Smith, Garnett and Randall of Great Britain discovered that cold rolling with *high* (over 60 per cent) *reduction* endows the strip with unexpected magnetic properties. The permeability of the finished material at 10,000 B is twice as good and at 14,000 B fourteen times as good as that of the average commercial high-silicon hot-rolled sheets, while the 60-cycle losses at the lower densities are about 10 per cent better and at the higher densities 15 to 25 per cent better.

But these admirable properties of strip are highly directional; they apply only when the flux is along the gain of the strip; that is, along the direction of rolling. With the flux running *across* the grain (Figs. 2 and 3) the losses are as much as 70 per cent higher and the reluctance 300 per cent higher. As a result of this the designer was faced with a dilemma: (a) If he punched from his rolls conventional L-shaped pieces for his core he lost the improved permeability and low loss characteristic of the material completely in that leg of the L which ran cross grain, or if he punched his L at 45 deg. to the grain direction, then most of the advantage of the material was lost in the entire core; while (b) if he punched straight pieces from the roll along the grain to make up his core, he still had the handicap of flux running at an angle to the grain at the four corner zones of the core, and to that he added the magnetizing cur-

Fig. 4—Spiral core inserted in

(a) Wound core between rollers ready for assembly.
(b) Outside turn threaded through transformer windings and secured to adjacent turn.
(c) Core partly wound.
(d) Core completely transferred to coils.



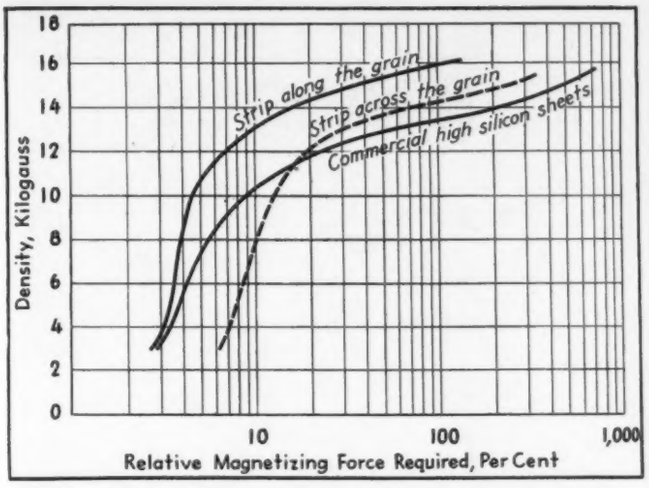

Density, Kilogauss
Relative Magnetizing Force Required, Per Cent
Strip along the grain
Strip across the grain
Commercial high silicon sheets

Fig. 2—Magnetization with grain of iron is advantageous

Relative d.c. magnetization of cold rolled strip some 20 per cent better than commercial high silicon sheets.

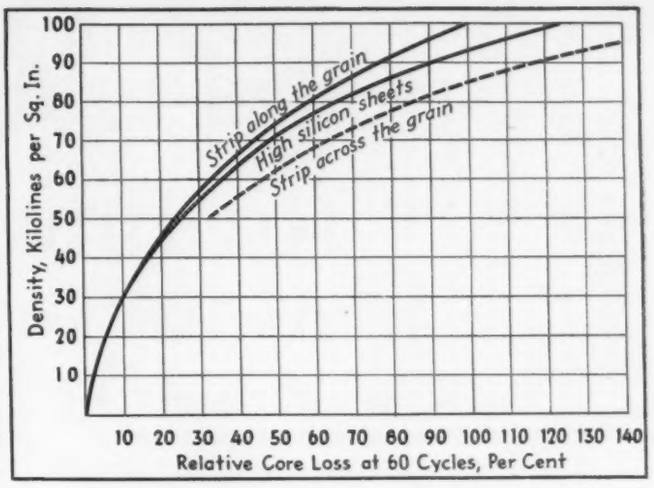

Density, Kilolines per Sq. In.
Relative Core Loss at 60 Cycles, Per Cent
Strip along the grain
High silicon sheets
Strip across the grain

Fig. 3—Loss for given density lower for with-grain magnetization at 60 cycles

rent and losses of two additional joints. Thus, he lost in the corner zones and additional joints more than he gained through the superior magnetic characteristics of the material.

Obviously, to realize the best characteristics of this material in a transformer, the material must be used in the same form in which it is manufactured, that is, not as stacked-up punchings, but as a wound roll, so that (a) the flux will be along the grain direction (the direction of rolling) at every point of the core, that is, in each convolution of the roll, and (b) there will be only one gap of shortest possible length and largest possible cross-section so as to offer a negligible reluctance to the closure of the flux between the convolutions. Laboratory tests have verified that the magnetic reluctance of a tightly wound roll is only slightly more than that of the material itself; that is, a properly wound core is practically equivalent to a jointless core.

While winding up both the core and the coils of a transformer would be ideal from the manufacturing standpoint, this has been rendered impractical until very recently by one peculiarity of all magnetic materials. The superior magnetic qualities of both sheets and strip are developed only by certain highly developed and carefully controlled annealing operations, and therefore any mechanical straining of the material subsequent to anneal, as by bending or unbending for winding, stretching or shrinking, or compression by tight clamping, increases the losses very materially. Annealing reduces the losses by as much as 50 per cent; strains introduced by subsequent change in shape or dimensions, even within the elastic limit, may increase them by 30 to 40 per cent.

Coiling sacrifice averted

As might be expected, the more highly improved steels are also the most sensitive to strain. If a roll which has been carefully annealed to develop its best magnetic characteristics is rewound without change in size, but reversing the order of the turns, so that the inside turn becomes the outside, and *vice versa*, the small elastic stresses caused by the resulting increase in the radius of what were, during anneal, the inner convolutions, and the reduction in the radius of what were, during anneal, the outer convolutions, may increase the losses 15 to 25 per cent. Even if the roll is not rewound, but merely loosened and retightened to 10 per cent larger or smaller diameter, the losses may increase by 10 to 15 per cent.

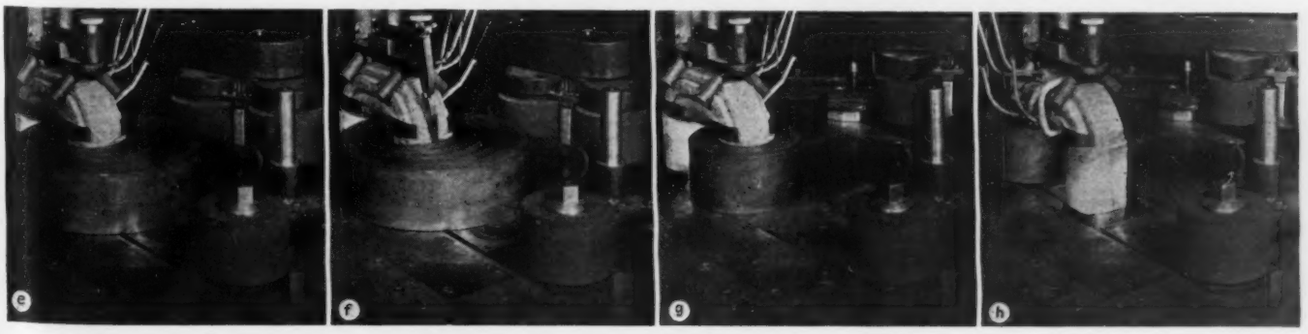
Thus, it is seen that to be able to secure the best characteristics of strip it must be used not only in the form in which it is manufactured, but also in the exact physical condition in which it is annealed. As annealing temperatures approach dull red heat, the core cannot be reannealed after the transformer is completed, and the designer is faced by what appears to be an impossible problem—to interlink the high-grade, heat-treated wound core with the highly reliable form-wound pretreated winding, without straining the material of the core or hurting the insulation of the winding.

Wound cores have been used in the industry for some time, but only in applications like bushing type current transformers in which the pri-

[*Continued on page 103*]

novel sequence of operations

(e) Inner core roller removed.
(f) Inside turn of core clamped to coil insulation. Outside turn freed to permit tightening.
(g) Core "snugged" into position.
(h) Coil reversed preparatory to insertion of second core.



Street-Lighting Business for Small Cities

West Penn's Organized, Long-Range Planning for Municipalities Proves Mutually Profitable

By P. H. POWERS

Vice-President West Penn Power Company, Pittsburgh, Pa.

SELL street lighting? Why not, there is a market for it. People need it and can afford to have it. We know something about proper applications. Fine equipment is available. The service is useful and beneficial. Like anything else, if people want it, they will find a way to pay for it. Furthermore, we think it is profitable business.

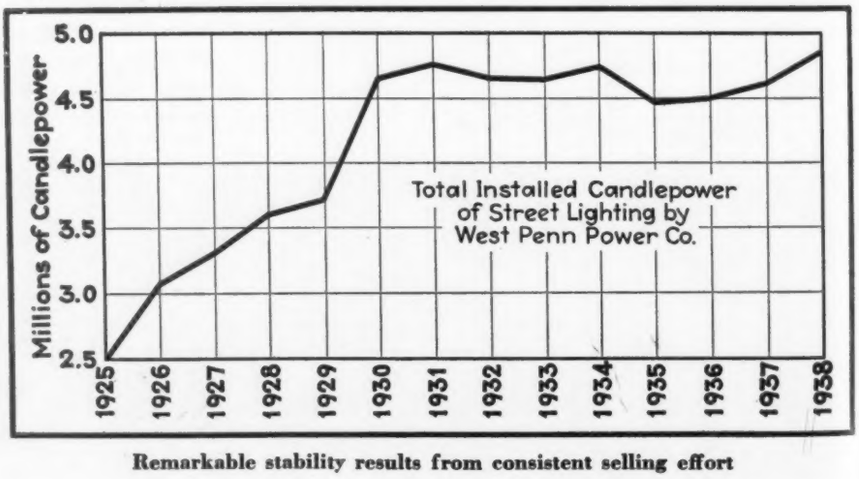
So, we merchandise street lighting and view the promotion of this service as one of the family of similar services, including lighting in the home, store, school and office.

The first step is to clear the way. It seemed an impossible task in 1920. A wide variety of rates distributed among a couple hundred small communities, little or no uniformity in term or terms of contracts and every known size of lamp from 40 cp. to 600 cp. were conditions to be faced. Salesmanship and determination cleared up the rate and contract situations by 1923. This period also saw the elimination of all lamp sizes under 100 cp. Therefore, we have had the advantage of a uniform rate, contract and lamp sizes as a foundation to build on over the past fifteen years.

During the early 1920's many of the leading utilities began to do a real selling job in street lighting. Fine results were accomplished. Aggressive selling on our part was determined upon in 1925 and active promotion undertaken shortly thereafter. The 1929 crash and the "1932 depression" fell as a curtain across a fast-moving program of customer education and selling results. It was even more than a curtain, because it introduced a brand new set of problems involving such interesting situations as "keeping down with the Jones'," in which each community seemed to vie with the other in asking for eliminations and cuts.

The educational program of the previous few years instead of being a total loss proved to be a most useful bulwark in defense against these installation reductions. Educational and sales efforts were intensified, therefore, rather than diminished, with the result that no substantial loss was suffered in existing street-lighting business during the depression period. The company, however, did take on a temporary load of deferred accounts. While some utilities slowed down or stopped their sales effort entirely during the depression, we plowed on. We had to! We were like the old Indian who had "to paddle like hell to stand still." This proved to be a sound policy, from the point of view of protecting the installations, avoiding the expense of withdrawals and repacements, maintaining good will of the community and avoiding a calamitous loss of business.

After 1932, as times grew better, the program suffered another obstacle in the competitive effect of PWA and WPA funds. Communities were anxious to avail themselves of government philanthropy and were led to use these means of providing employment. Cities with needs such as improved streets and sewers, seeing the opportunity to acquire free



Remarkable stability results from consistent selling effort

funds substantially equal to their own contributions, could hardly be blamed for using their available cash for these purposes. Street lighting could wait, and did. Therefore, the period from 1932 to 1937 had to be devoted largely to consolidating the company's position, to continuing public education on the value of street lighting and to creating a pent-up desire for it in the minds of municipal authorities.

Then came a new problem to plague us. All our contracts are for five-year periods. While we could use the contractual obligations to resist demands for reductions in size and number of units, we couldn't get a good toe-hold against an expiring contract and were forced to take enough cuts to produce some net installation losses from the high of 1931 during the next five years.

As a preliminary to a new selling effort and a further step in simplification, we took a leaf from depression experience and introduced a new size of lighting unit. Prior to this time our schedule offered units of the following sizes: 100, 250, 400, 600, 1,000, 1,500 and 2,500 cp. In a great many municipalities, when we were forced to accept a reduction in installation to the next lower size —for example, from 1,000's to 600's, from 600's to 400's, or from 400's to 250's (these sizes representing the bulk of our revenue)—we found that the observable loss in street illumination was not sufficient to raise any serious public objection. Likewise, when we attempted to resell the original installation, we were faced with the challenge that the additional illumination was not worth the price.

After scratching away at our bald spots over this one, we decided to eliminate the 400- and 600-cp. units and substitute for them a 500-cp. unit. We put it up to the manufacturers and they went along on the new 500-cp. size. We now offer the following sizes: 100, 250, 500, 1,000, 1,500 and 2,500 cp. Within the range of most general usage there is now sufficient difference in illumination to be very apparent, and with the obvious sales advantages, whether going up hill or down. This new unit was priced the same as the old 400-cp. unit. Those who saved money by replacing their 600's with 500's could employ these savings in the extension of their street-lighting facilities and the others acquired more illumination for the same money.

Prior to the development of the 500-cp. unit we had been conducting an assault on the 100-cp. size in an effort to replace it with 250's wherever possible. We labeled and called it an "alley light." By means of this squeeze play more than half of these were replaced by the 250's. Progress in this direction is evidenced by the comparison of the 1929 and 1938 installations.

Beginning in the latter part of 1937, the company felt the time was ripe to press for new sales results. Taxes were beginning to come in again to municipalities. Many of the communities began to show signs of solvency. Uniform street lighting standards had been established. We were now ready to devote our time and effort to selling. Thus we introduced the current wave of selling effort.

The first question is *Where to sell?* Chiefly, this means selling more lighting to those who now have inadequate installations and concen-

Before and after views of a principal street in Greensburg show improvement resulting from installation of Westinghouse "Reflectolux Junior luminaires

Before and After Results of the Greensburg Installation

Candlepower	Old	New
100	0	0
250	425	393
500	152	502
1,000	4	35
1,500	30	0
Total candlepower	231,250	384,250
Annual net	$20,079.56	$32,263.85
Cost per capital	$1.22	$1.95

Municipal street lighting program of West Penn Power embraces relighting of all streets as shown in this example. Note absence of glare and vastly improved distribution of light in this treatment of a secondary street

trating the selling effort upon those communities which have or offer reasonable hope of having sufficient financial responsibility to assume additional operating expenses.

The next question is, *How much to sell?* Obviously the aim is to sell a complete city-wide job, but if the financial outlook of a city is such that it cannot relight its entire area, then an effort is made to sell proper lighting in restricted areas rather than a general increase over the entire town or city. Each street and intersection needs lighting according to its own tailor-made requirements.

New sales contacts are carefully planned. Public opinion and public desire are aroused through educational advertising, newspapers and direct mail in the affected areas, and occasionally through demonstrations consisting of modernizing a block or an intersection. The public and the city officials are inoculated with the benefits of properly designed and adequate street lighting, which include:

Aid to police and fire departments.
Increased real estate values.
More sanitary street conditions.
Stimulation of civic pride.
Improved traffic control and fewer accidents.
Greater comfort and convenience for those using the streets.
Increased business for local merchants.
Protection.

The latter is emphasized most in regard to freedom from burglary, hold-up and personal molestation. Emphasis is placed on safety for motorists and pedestrians and from personal accidents due to street irregularities, obstacles and the like. The selling and promotion philosophy is a recitation of the above customer benefits plus an appeal to pride, plus keeping up with the Jones', plus fear of the dangers of inadequate lighting, plus a challenge to official responsibility.

Close co-operation

At the outset, when it is determined that a municipality can reasonably be expected to provide its proper street-lighting requirements, close co-operation is sought with the engineers and other municipal officials. An effort is made to stimulate their enthusiasm to the point where they will get on the bandwagon and make the issue a cause. Different and conflicting interests are reconciled. The next step is to prepare a carefully engineered city-wide plan worked out in close conjunction with the city fathers, based upon the tailor-made needs of every street of the municipality. This we called a planned program. It is first presented as a goal for the city to work toward over a period of time, usually from three to five years. The experience, however, is that most plans do not take that long for their consummation, and some are executed at one step. During the preparation of these plans public education is taking place, so that when the project comes up for official action the impelling influence of an aroused public desire is felt.

Of necessity, the utility must have an adequate force of specially trained men for this work; the full support, interest and co-operation of all of its representatives in the community; close and friendly contacts and relationships with municipal authorities, and an established record of ethical dealings. No misstatements or overstatements, promises or false predictions can be made in selling street lighting any more than in any other successful selling activity. Basically, good service is presumed, including periodic renewals and frequently scheduled cleaning.

These specialists are primarily salesmen—all five of them. They are lighting experts to the extent that the industry has provided training facilities in proper street-lighting applications. To a similar degree,

[*Continued on page 105*]

Rectifiers Adopted for American Aluminum

By D. I. BOHN and W. E. GUTZWILLER

Electrical Engineer
Aluminum Co. of America
Pittsburgh, Pa.

Rectifier Engineer
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

ELECTRICAL energy is one of the major "raw materials" in the electrolytic reduction of aluminum, large quantities of direct-current energy being required at aluminum reduction plants. Such large blocks of power can usually be generated and transmitted more economically in the form of alternating current than as direct current. Power conversion must therefore be resorted to at the point of power consumption.

Conversion of alternating current to direct current considerably increases the cost of power due to investment in converting equipment, conversion losses and operating and maintenance expenses of conversion stations. It is therefore obvious that where power cost represents an important part of the cost of an electrolytic product, as is the case with aluminum, great care must be taken in choosing the proper type of conversion equipment.

Aluminum Company of America has heretofore used rotary converters, and to a limited extent motor-generators, for this purpose. With the advent of business improvement last year additional conversion equipment became necessary. Careful comparisons were made between the various forms of conversion equipment available, these comparisons involving a study of the following factors:

1. Investment cost per kilowatt load.
2. Over-all operating and maintenance cost.
3. Over-all conversion efficiency.
4. Power factor.
5. Voltage and load control.
6. Time of service resumption after power interruption.
7. Effects of conversion equipment on system stability.

The study involved motor-generator sets, rotary converters, with and without voltage control, and grid-controlled mercury-arc power rectifiers.

First in United States

Although rectifiers have been successfully used for many years in American and Canadian plants for electrolytic production of chlorine-caustic, hydrogen-oxygen, zinc and cadmium, no installations have been made for reduction of aluminum in the United States. The requirements imposed on the converting equipment of an aluminum reduction plant are probably as severe as for any electrolytic process. Direct currents of large amounts are required continuously to operate the reduction cells or furnaces.

There are a number of these furnaces connected in series and connected to a d.c. voltage source of approximately 600 volts. This requires a number of conversion units of relatively high kilowatt capacity to be continuously operated in parallel on a common d.c. bus, the short-circuit capacity of which naturally reaches very large proportions. Furthermore, continuity of power supply to the furnaces is of utmost importance in order to prevent the molten furnace charge from freezing, with consequent serious damage to the furnace lining, expensive restarting and prolonged plant shutdown.

It has only been in recent years that large rectifier units have been perfected to a point where they could meet the exacting requirements of aluminum reduction plants. With the introduction of electronic grid control, it has become possible to control the load of rectifiers operating on a common bus in normal operation, as well as during starting periods, and to interrupt the rectifier arc and limit fault currents in case of arc-back or short circuits in the short time of one cycle.

The investigation, carried out by engineers of Aluminum Company of America, of the over-all economy of motor-generators, rotaries and rectifiers favored the latter, with the result that the first two large rectifier stations in the United States were made last year, one at Alcoa, Tenn., and the other, a duplicate as to equipment but half as large, at Massena, N. Y. Both installations are additions to existing reduction plants.

The Alcoa rectifier station, a single-line diagram of which (along with certain apparatus details) is shown in Fig. 1, has a capacity of 55,000 kw. The station contains ten 5,500-kw., double-tank, grid-controlled rectifier units.

D.c. and a.c. protection

One bake-out transformer is provided for baking out one rectifier tank at a time. It consists of a 420-kva., 13,200/1,760-volt, three-phase, outdoor transformer, which can be connected to one of the two high-tension buses, thus supplying any one of the main rectifier transformers with 1,760 volts, which gives a rectifier d.c. voltage sufficiently low for bake-out purposes.

Necessary current transformers are provided in the primary leads of each rectifier unit and one set of potential transformers per high-tension bus. These metering transformers take care of a.c. protection and metering.

The cathode or positive terminal of each rectifier tank is connected to the main positive bus through an ammeter shunt and a 6,000-amp., single-pole, electrically operated, high-speed, d.c. breaker, provided with reverse current trip attachment. The negative terminal of each rec-

tifier tank, originating in the rectifier transformer, is connected to the main negative bus through a 6,000-amp., single-pole knife switch.

For centralized control and metering of all equipment a fourteen-section benchboard, located in the center of the substation, is provided. This benchboard consists of eleven rectifier control sections, one of which is a spare, and three sections for control of incoming a.c. and d.c. lines.

A 240-amp.-hr., 125-volt control battery with motor-generator charger furnishes all the control power.

Less space than rotaries

The space and weight requirements of rectifiers permit the construction of a station considerably reduced in height and width as compared to a rotary converter station. All indoor equipment is located on one floor and a basement was therefore dispensed with. The main d.c. buses are outdoors (Fig. 2) and are supported by the station walls.

The building containing the twenty rectifiers with auxiliaries, control and d.c. switchgear, and one spare bay, occupies a floor area only 30 x 312 ft., or 9,360 sq.ft., which, based on installed rectifier capacity, corresponds to the high value of 6 kw. per square foot floor area.

A 6-ton crane was all that the rectifiers required instead of a 15- to 40-ton crane, as required in rotary converter or motor-generator stations.

The rectifier station is laid out, both physically and electrically, to make each rectifier tank an independent, self-contained unit. The control scheme, involving a somewhat conventional benchboard, differs from usual practice in that all 125-volt battery control power for each pair of rectifiers is fed through one inclosed air circuit breaker, this breaker having both a high rated instantaneous trip and a lower rated thermal trip. No fuses whatever are employed at any point in any control circuit. No control buses, such as are normally employed for supplying all closing coils, etc., are used, so that when a pair of rectifiers is out of service and its battery control and the a.c. control switches are open all control equipment at the rectifiers on the benchboard associated with this rectifier pair is dead.

Scheme of operation

The station is electrically divided into two groups of five transformers and ten rectifiers each, with a 20,000-amp. d.c. breaker used as a tie switch between the halves of the main positive bus. In normal operation this tie breaker is closed, thus paralleling the twenty rectifier tanks with a total normal load of 90,000 amp., 54,000 kw. This bus represents probably the largest concentration of rectifier energy that has ever been attempted, and naturally required reliable switchgear and protective apparatus to prevent damage of any part of the installation in case of fault.

Provision is made, both with respect to the main switching and the auxiliaries, so that, if desired, the station may be electrically broken into halves, both with reference to the a.c. power supply and the d.c. load. This is done on the 13.2-kv. side by utilizing the double bus arrangement.

Grid voltage control, which is used for controlling the load of individual units and the voltage of the cell room circuits, is provided from the benchboard, a maximum of 35 per cent voltage reduction being

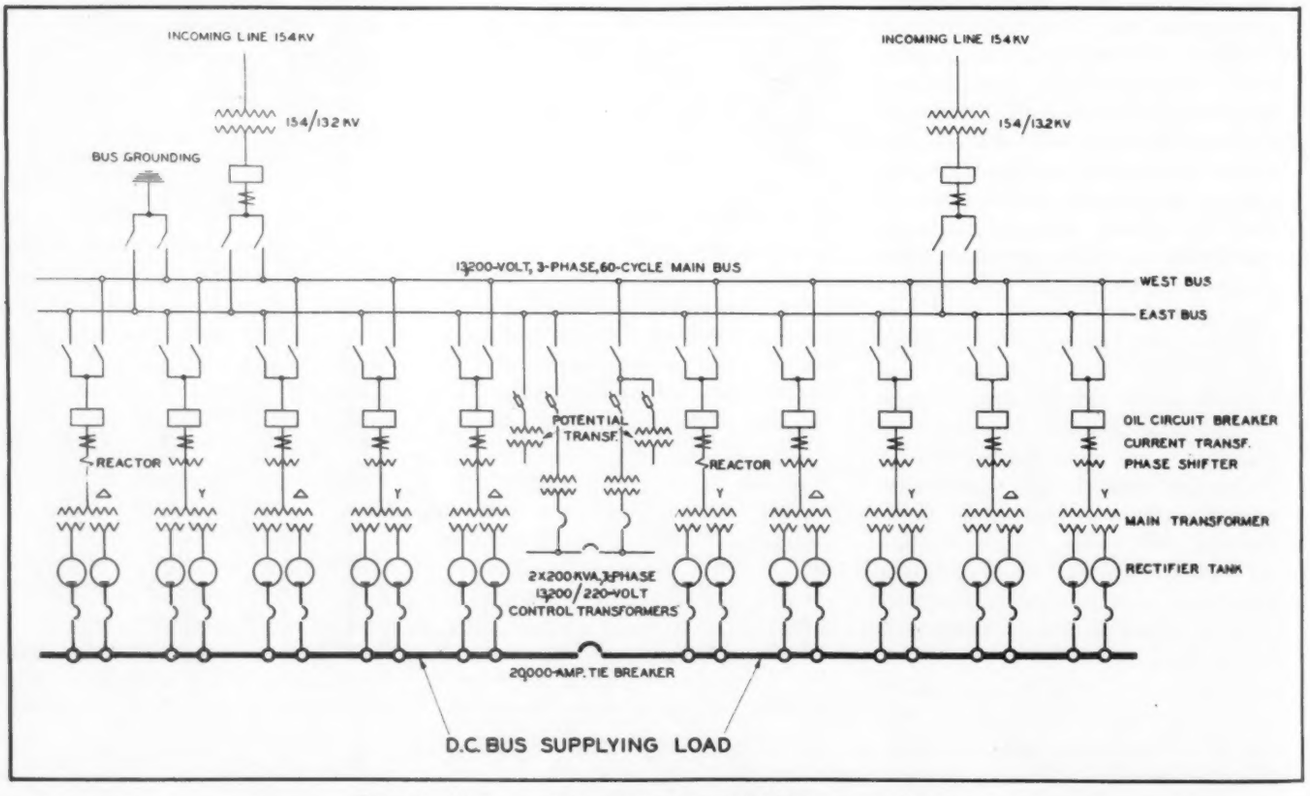


Fig. 1—Alcoa rectifier station has 55,000 kw. capacity

Two lines serve ten 5,500-kw. double-tank, grid-controlled rectifier units. Each rectifier tank is rated 4,583 amp., 600 volts and has twelve main anodes operating in double six-phase connection. Two of these tanks are connected to a common oil-insulated, self-cooled, 45 deg., C., outdoor rectifier transformer, of which there are ten installed. Fans are provided on the transformer radiators, permitting operation at a lower temperature rise during hot weather. The primary winding of each transformer is designed for 13,200 volts, three phase, 60 cycles and has a rating of 6,310 kva. Three 2½ per cent, full capacity taps above and three below normal voltage are provided and connected to a no-load tap adjuster. Half of the transformers are delta connected and the other half star connected.

The secondary windings are designed for four times six-phase, 562-volt phase voltage, connected to four interphase transformers built into a common tank with the main transformer. Twenty-four secondary, two negative and three primary bushings are provided on each main transformer cover.

available. The benchboard contains individual control switches for the grid control of each individual rectifier tank, as well as a master control, from which can be controlled any number of rectifier tanks. Because of the proportional decline in power factor, when voltage reduction is obtained by grid control, it normally is employed only to reduce the voltage approximately 5 per cent, this being sufficient, however, to provide constant d.c. voltage on the furnace circuit, with slight daily variations in a.c. line voltage, and also to take care of equal load division among the various rectifier tanks.

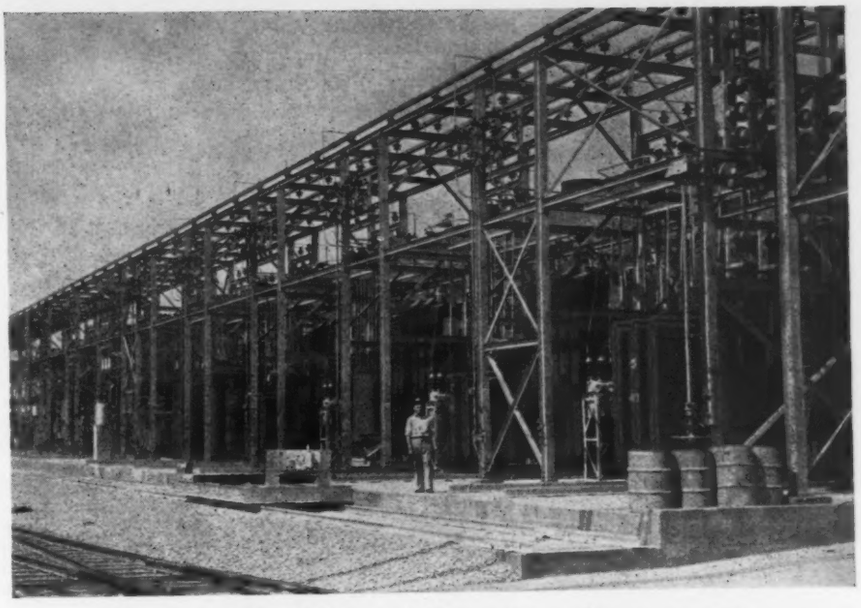


Fig. 2—Outdoor 13.2-kv. switching and transformer structure

The rectifier transformers are connected to the 13.2-kv. station bus through a 23-kv., 150,000-kva., electrically operated, outdoor type oil circuit breaker. Phase-shifting type auto-transformers and reactors are connected in the 13.2-kv. leads to each rectifier main transformer. The 13.2-kv. bus structure consists of a double bus arrangement with necessary disconnecting switches, so that either or both buses may be employed to feed all or any number of rectifier units. Two 200-kva., 13,200/220-volt, three-phase, station control transformers, one per bus, are provided for the substation, one transformer normally carrying the entire auxiliary load of the station. Two 42,000-kva., 154/13.2-kv., step-down transformer banks supply power to this station and also some of the rotary converter load.

Reduction of backfires

Since backfires in a rectifier do occur, although very infrequently, one of the most important problems in the design of such a large installation is to protect against rectifier and transformer damage caused by the a.c. and d.c. components of the backfire current. The a.c. portion of the backfire current produced by the short circuiting of the secondary phase voltage within the backfiring rectifier is supplied by the a.c. network. The d.c. portion consists of the combined d.c. back feed of all parallel rectifier tanks. These fault currents flow through the rectifier to backfiring anode and the corresponding secondary winding of the rectifier transformer. The sustained values of these backfire currents are greatly in excess of what is generally considered a maximum safe value for modern power transformers.

In order to obtain satisfactory plant operation, it is essential to provide reliable high-speed protective and switching devices which remove a backfiring rectifier from power source and load before the fault currents reach dangerously high values, and furthermore to design the equipment so that it can withstand the unusual stresses occurring under such conditions.

As is well known, grids in the arc path of a rectifier, when properly energized, will prevent the reignition of the arc during the positive half cycle after an anode has been idle for only a short period, as is the case during each negative half cycle. This grid property is utilized to prevent reignition of anodes working in parallel with the backfiring anode, and thus permits the interruption of the flow of a.c. power into the backfire and limits the amount of d.c. back feed. In this installation high-speed current relays actuated from current transformers in the primary leads of the rectifier transformers are provided. Upon occurrence of a backfire, they apply blocking voltage to all the grids of the backfiring tank and its twin unit, thus instantaneously stopping the current flow from the good anodes of the two tanks. The backfiring tank, however, receives d.c. back feed flowing from the positive bus to the cathode, backfiring anode, transformer secondary winding to the negative bus. This back feed, being direct current, cannot be interrupted by the grid on the backfiring anode.

Rapid cathode breaker action

The d.c. back feed is cut off by the high-speed cathode breaker through its reverse current trip attachment. Tests have shown that this breaker interrupts the back feed into the backfiring unit in about ¾ of a cycle (60-cycle basis) while the high-speed grid relays interrupt the a.c. portion of the backfire in approximately the same time interval. Tests furthermore indicate that the back-feed current in this installation builds up at the rate of 3.5 to 4 million amperes per second. The sustained back-feed current with ten or more rectifier tanks in parallel was calculated to reach values of the order of 100,000 to 120,000 amperes in 3 to 4 cycles. Due to their fast action, the high-speed d.c. breakers limit the back-feed current to values of the order of 30,000 to 35,000 amp. peak, or only about one-fourth of the sustained values mentioned above.

The grid protective relays are set to operate when the primary current of the rectifier transformer exceeds approximately 250 per cent rated load. If a backfire in a double-tank unit is properly cleared by the d.c. breaker the back-feed current is cut off before it can reach 250 per cent rated current on the parallel units. Consequently the grid relays of these units will not normally operate. Should, however, a breaker fail to trip, or be delayed in opening, then the other parallel operating rectifiers will also be blocked by grid control cutting off the back feed, thus preventing serious damage to the equipment. The grid blocking may also function on all units in case of a severe bus short circuit. The grid-blocking equipment therefore acts as a back-up protection for the d.c. switchgear.

The 13.2-kv. oil circuit breakers are equipped with overload relays with inverse time trip attachment. They will trip in case of a backfire either by interlocking from the cathode high-speed breaker, by the function of the grid-blocking relays or by the a.c. overload relays with time delay. The oil circuit breaker is therefore used only as a back-up protection for the grid control and for starting and stopping of the unit. In order to save first cost of rectifier switching equipment, these oil breakers were chosen of relatively small capacity, capable of handling only arc-backs and regular switching. In case of a transformer fault, currents may build up beyond the capacity of these breakers. In this

case suitable relay equipment will trip the main breaker supplying the power to the 13.2-kv. bus and prevent tripping of the corresponding rectifier oil breaker.

Performance gratifying

The protective schemes described above have worked out very satisfactorily in several months of commercial operation of the plant. In case of a backfire, with either twenty or ten tanks in parallel on a common bus, only the backfiring unit has tripped. The remaining units stayed on the line and carried the load while the tripped unit was returned to service, which required approximately one minute. Due to the rapid functioning of the protective and switching devices, a backfire has no noticeable effect on the power system supplying the station, nor on the commutation and stability of the rotary converters operating in parallel with the rectifiers on the same 13.2-kv. bus. Although it is not intended to operate the station as such in parallel with the existing rotary converter station on the d.c. side, provision is made so that one or two rectifier tanks may parallel with the rotary converter station. Backfires which have occurred with these units during the starting period of the plant, and when paralleled, have not even been noticed at the rotary converter station.

During lightning seasons power interruptions, while not frequent, do occur. It is usually a matter of considerable delay, such as 30 to 40 minutes, to resume service in a rotary converter station. With the rectifier station this never takes more than a few minutes. In the event of power failure the cell room breakers open automatically with time delay. When the d.c. voltage on the main bus disappears the rectifier cathode breakers drop out and open the rectifier oil circuit breakers through interlock. When power is resumed all the rectifiers are automatically ignited. Thereafter the primary and cathode breakers are closed from the benchboard, thus energizing the d.c. bus. When the proper number of units is connected to the bus the cell room breakers are closed, thus establishing the load.

While it was found possible to leave the rectifier primary breakers closed upon power failure, and have all rectifier transformers energized simultaneously upon return of system voltage, it was found desirable, due to the high momentary exciting currents taken by the ten transformers, to follow the first-mentioned method of starting.

The station is equipped without spare units, in the normally accepted sense of the term. With the total load of the cell rooms of 90,000 amp., each of the rectifier tanks will be carrying about full load current. It is felt that, in emergency, rectifiers should be capable of carrying, for a reasonable time, a 10 per cent overload without seriously shortening the life and increasing the maintenance cost. Thus it should be possible to have as many as two rectifiers out of service if all twenty tanks are operating in parallel normally, or one rectifier out of service when operating the two station halves as separate units with ten tanks per section. It is expected that this will be sufficient for all ordinary maintenance, including opening a rectifier at expected intervals of several years.

Control of harmonics

If a rectifier station is supplied from a system having a sine wave voltage the current drawn by the rectifier will have a number of harmonics in it. The order of these harmonics will be one above and one below all multiples of the phases employed, this term referring to the station as a whole and not to individual units. Such harmonics, if of certain frequencies and of sufficient amplitude, may cause telephone interference, this being dependent to a large extent on the severity of the exposures existing between the transmission system involved and the telephone lines, the system electrical constants and the ratio of rectifier load to total system load.

There are two general ways of eliminating or modifying the severity of such harmonics, as follows:

One of these is to employ shunt filters in the main power supply. In general such filters consist of a condenser and a reactor, the pair being connected in series across phases. The value of the capacitance and reactance is selected so that the filter is resonant at whatever frequency it is desired partially to eliminate. If several frequencies are predominant to a sufficient degree to make filtering advisable it is necessary to employ a filter for each of these frequencies.

Another method is to shift the phases of certain units so that the result, referring to the station as a whole, is a multiple-phase system. This method was adopted at both the Alcoa and Massena stations. At each of these stations an operating unit may be considered as ten rectifiers and five transformers. These five transformers will be either three delta and two star, or the reverse. Such a combination alone would give a 12-phase system, except for the odd delta or star unit, and would therefore eliminate, except for the odd unit, all harmonics below the eleventh. The eleventh and thirteenth harmonics, however, were found to be the most pronounced harmonics with respect to telephone interference, and they are present in full with even a perfectly balanced 12-phase system.

Additional measures were therefore employed to increase further the number of phases. By using the two delta and three star units, or the reverse, and fitting two of these units with 6 deg. lead and lag phase-shifting auto-transformers, two others with similar 12 deg. lead and lag transformers, a true 30-phase system will result. This method is employed at both stations, and thorough tests have shown that the theoretical conditions expected obtain to an extremely high degree. All harmonics below the twenty-ninth are practically eliminated when the load on the ten tanks fed from five transformers is balanced. Even with an appreciable unbalance, or with a unit out of service, the harmful harmonics are suppressed to such a low value as to cause no trouble.

Because one-half of the Alcoa station has three delta and two star transformers and the other half has the reverse, both halves being supplied with the same phase-shifting transformers, the result with the two station halves in parallel is a true 60-phase system, this eliminating, under balanced conditions of load, all harmonics below the fifty-ninth. Any harmonics existing above the twenty-ninth, even if present to an appreciable degree, are practically harmless in so far as telephone interference is concerned.

The two types of auto-transformer phase shifters employed were designed to have the same percentage impedance based on the rectifier transformer rating. One of the rectifier units in each half of the station has no phase-shifting transformer, so that, if nothing were done, the regulation of this unit would be lower than on the other units which have the additional small impedance present in their phase-shifting auto-transformers. For this reason a small iron core reactor was placed ahead of the rectifier transformer, which required no phase shifting. The regulation of all units therefore is the same, so that practically the same amount of grid control can be used on all units to provide balanced load.

Advantages realized

It is of course too early to know to what exent the expected advantages of the rectifier station will materialize as compared with rotary converters or motor-generator sets. The experience to date seems to show that most or all of the expected advantages are present, and that the yearly over-all operating cost will be appreciably lower.

Power Systems Modernized for Service

FINDING good service to be the key to highly gratifying increases in domestic and commercial sales, Utah Power & Light Company has followed a unique plan for modernizing its service facilities in the Salt Lake division. The entire lines and service department of the division, numbering 175 employees, was provided with new quarters into which was built the spirit of electric service at its best.

The division's territory covers an area of 53 square miles within the city limits and includes suburban districts, neighboring towns and rural areas, amounting to 365 square miles, some portions of which are as much as 25 miles from the center of the city. The scope of the work includes maintenance and operation of 1,300 miles of 4-kv. and 11-kv. distribution lines, construction of urban and rural extensions, operation and maintenance of all substations and construction in connection with substation extensions. Appliance merchandising is carried on, with attendant shop activities. About 56 automobile trucks and passenger cars of various types are used.

The old quarters, located in the heart of the commercial district of Salt Lake City, were becoming very congested and inconvenient by 1936. A substantial brick building owned by the company and located about a mile from the commercial district was available, having a floor area of 25,000 sq.ft. It had formerly been used as a car barn. At an expense of $90,000, it was completely remodeled so as to provide offices, material stores and supply rooms and garage space for cars and trucks. Conveniently arranged unloading platforms, elevators and handling devices were provided so that the labor of unloading, storing and reloading has been reduced to a minimum. Better light and improved shop arrangements resulted in speeding up all forms of shop assembly and repair work.

In addition space was found for an assembly room, with a seating

[*Continued on page 101*]

Former car barn, remodeled by the addition of concrete floors and fireproof partitions

Improved loading facilities

In the morning each line crew loads material previously stored in designated booths. Meter and appliance service men start fifteen minutes later. Three storeroom men supply material to 110 men—no delay or confusion.

Meter testing laboratory

Better light and improved arrangements speeded up all shop assembly and repair work.

Choosing Location, Form of Additional Generation

Multiplicity of Alternative Plans Canvassed Thoroughly as to Cost, Economy and Operating Flexibility Before Making Definite Decision

By R. K. LANE

Vice-President in Charge of Operation, Design, Construction
Public Service Company of Oklahoma, Tulsa

THAT the cheapest power generation cost for immediate conditions is not always the wisest decision to make for the long-range answer is well demonstrated by the analysis made for augmentation of the generating capacity of the Public Service Company of Oklahoma.

Thus a rigorous study made in 1936 showed conclusively that it was more prudent to add 20,000 kw. to the 30,000 kw. already functioning at West Tulsa station rather than to rebuild 30,000 kw. of existing units at the Weleetka station for an additional 10,000 kw. of output. The former plan would add 20,000 kw. at a unit cost of $45.60, whereas the latter would add 10,000 kw. of capacity at a unit cost of only $25 per kilowatt.

However, this latter capacity would be removed 60 miles from the load center at Tulsa and within two years it would be necessary to add further capacity somewhere on the system, probably at a higher price than at present prevailing for generating equipment.

Four plans considered

In all, four plans were considered before the exhaustive studies showed plan A to be the wisest:

Plan "A"—Installation of a 20,000-kw., 225-lb., turbo-generator unit in the West Tulsa station.

Plan "B"—Installation of a 20,000-kw., 1,200-lb., 900-deg. superimposed unit on the West Tulsa station. Plan "B" also proposed the installation of a 15,000-kw., 1,200-lb., 900-deg. superimposed unit at the West Tulsa station.

Plan "C"—Installation of a 20,000-kw., 625-lb., 775-deg. turbo-generator unit in the West Tulsa station.

Plan "D"—Changes in the turbo-generator units in the Weleetka station to increase their capacity.

It was quickly found that plans B and C would result not only in cost of power produced being higher than either of the other two plans but also in creating a system operating set-up of less favorable flexibility.

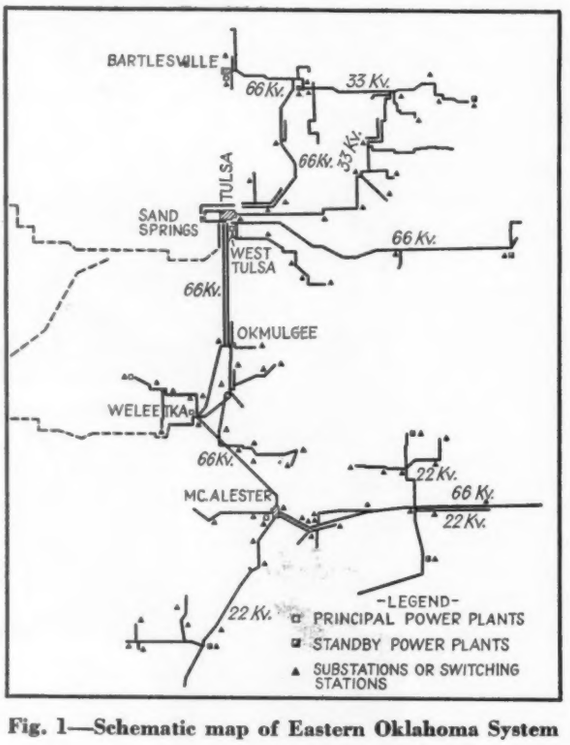


Fig. 1—Schematic map of Eastern Oklahoma System

Consequently the plan recommended as the most economical, practical and adequate was the installation of a 20,000-kw., 225-lb. turbo-generator unit, suitable for subsequent operation at 450-lb. pressure, in the West Tulsa station. The cost was estimated at $912,000, with $367,937 to be incurred later to convert the 20,000 kw. to the higher pressure. Table I shows the comparative investment costs of all but plan D, which for aforesaid reasons was not practicable.

In making the "A" recommendation it was recognized that the water supply at West Tulsa station will be adequate only for the 20,000-kw. unit thereby to be installed. It appears that a topping unit of 1,200-lb. pressure, 900-deg. temperature would be suitable for the next installation in this station to bring the capacity up to 70,000 kw. It would require no increase in circulating water and would result in an over-all cost of energy production equal to that of the most economical stations.

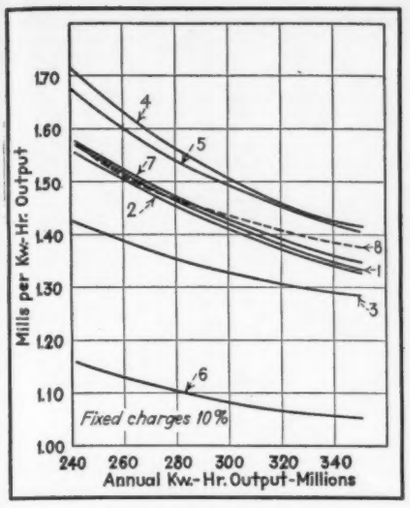


Fig. 2—Total annual fixed charges and fuel costs for alternative schemes of capacity expansion

Capacity existing on the system (See Fig. 1) under consideration was as follows:

Station	Capacities	Total	Character
West Tulsa	10,000+10,000 + 5,000+5,000	30,000	Firm
Weleetka	15,000+15,000	30,000	Firm
McAlester	.....	8,500	Standby
Bartlesville	.....	2,750	Standby
		71,250	

With one of the 15,000-kw. units at Weleetka out of service the firm capacity would be 56,250 kw. Peak has been increasing 4,000 kw. per year and the peak in 1944 might well be 71,000 kw. It appeared that 20,000 kw. should be the increment added. The 1936 peak served in Tulsa and north of Tulsa was 34,000 kw., an amount in excess of the station rated capacity. This naturally prompted additional capacity at that load center station rather than elsewhere.

Load forecast

Load forecasting data indicated that a logically assumed percentage rate of growth would result in a 350,000,000-kw.-hr. output in 1944 with a total peak of 72,890 kw., or a Public Service Company of Oklahoma generation peak of 67,480 kw. This growth from 227,573,470 kw.-hr. in 1936 was made the basis of computations of combined annual fixed costs for the various proposed increments under several varying base loads and remaining load allocations between the West Tulsa and Weleetka stations. These are plotted in Fig. 2 against the kilowatt-hour output (ignoring dates as customary in load forecasting for system expansion).

Prior to these calculations it was necessary to determine the fuel costs for each of the eight conditions of operation (see Table II) for the respective hours annual duration in keeping with the attained load curve of 56 per cent load factor and for average kilowatt loads in keeping with increases in kilowatt-hour output already mentioned. The peak duration was taken as 100 hours. In all it was found desirable to make twenty tabulations similar to Table III, which is solely for conditions 1 and 2 and for the 1936 value of output.

Total fuel costs for the two stations were then combined with the fixed charges on the corresponding investment to establish the already mentioned values presented in Fig. 2.

Performance and bleed heating

The performance curve for the 20,000-kw., 225-lb. unit decided upon (Figs. 3, 4) shows that 675,077 lb. of steam per hour would be required under conditions of 50,000-kw. load on the station. As a check on the feasibility of later superposition a 20,000-kw., 1,200-lb., 900-deg. superfuel unit would supply 400,000 lb. of steam per hour, enough for the current 20,000-kw. unit and one of the already existing 10,000-kw. units. It would give a load-center capacity of 70,000 kw. without requiring additional condensing water.

Table II—Operating Conditions Assumed in Determining Generation Requirements

Condition No. 1—With proposed 15,000-kw., 1,200-lb. unit at West Tulsa station, base load West Tulsa at 11,500 kw., carrying next 30,000-kw. at Weleetka station and balance at West Tulsa.

Condition No. 2—With proposed 15,000-kw., 1,200-lb. unit at West Tulsa station, base load Weleetka at 6,000 kw., carrying next 39,000 kw. at West Tulsa station and balance at Weleetka.

Condition No. 3—With proposed 20,000-kw., 225-lb. unit at West Tulsa station, base load West Tulsa at 5,000 kw., carrying next 30,000 kw. at Weleetka and balance at West Tulsa.

Condition No. 4—With proposed 20,000-kw., 1,200-lb. unit at West Tulsa station, base load West Tulsa at 13,500 kw., carrying next 30,000 kw. at Weleetka and balance at West Tulsa.

Condition No. 5—With proposed 20,000-kw., 1,200-lb. unit at West Tulsa station, base load Weleetka at 6,000 kw., carrying next 49,500 kw. at West Tulsa and balance at Weleetka.

Condition No. 6—With present 15,000-kw. units at Weleetka rewound for 20,000 kw. each, base load West Tulsa at 4,000 kw., carrying next 40,000 kw. at Weleetka and balance at West Tulsa.

Condition No. 7—With proposed 20,000-kw., 625-lb. unit at West Tulsa station, base load Weleetka at 6,000 kw., carrying next 20,000 kw. at West Tulsa, next 24,000 kw. at Weleetka and balance at West Tulsa.

Condition No. 8—With proposed 20,000-kw., 400-lb. unit at West Tulsa station, base load Weleetka at 6,000 kw., carrying next 20,000 kw. at West Tulsa, next 24,000 kw. at Weleetka and balance at West Tulsa.

Table I — Study of Prime Mover Requirements Comparison of Investment Costs

	B. 20,000 Kw. 1,200-Lb. Unit	C. 20,000 Kw. 625-Lb. Unit	A. 20,000 Kw. 225-Lb. Unit	A. Additional Cost to Convert 20,000 Kw.— 225-Lb. to 400-Lb.	B. 15,000 Kw. 1,200-Lb. Unit
Turbo-generator	$490,000.00	$429,500.00	$422,000.00	$20,000.00	$344,000.00
Generator air cooler	12,000.00	12,000.00	12,000.00	.....	10,000.00
Condenser	.....	100,000.00	107,000.00	.....	.....
Heaters	15,000.00	13,000.00	12,000.00	.....	15,000.00
Building and foundations	175,000.00	175,000.00	100,000.00	75,000.00	175,000.00
Boilers, air heaters, econ., superheater and settings	450,000.00	217,500.00	.....	194,000.00	338,000.00
Boiler feed pumps	30,000 00	15,000.00	5,000.00	15,000.00	26,000.00
Piping	135,000.00	95,000.00	5,000.00	15,000.00	135,000.00
Pipe covering	10,000.00	7,000.00	4,000.00	2,000.00	10,000.00
Electrical	59,000.00	50,000.00	50,000.00	.....	50,000.00
Spray pond	.....	90,000.00	90,000.00	.....	.....
Instruments	9,500.00	6,000.00	4,500.00	2,000.00	9,000.00
Misc. steel galleries, gratings, etc	9,000.00	7,500.00	4,000.00	4,000.00	9,000.00
Supt. during construction	20,000.00	20,000.00	10,000.00	10,000.00	20,000.00
Engineering	(6%) 84,330.00	(6%) 74,250.00	15,000.00	(6%) 20,220.00	(6%) 68,460.00
Sub total	$1,489,830.00	$1,311,750.00	$885,500.00	$357,220.00	$1,209,460.00
G. O. supervision (3%)	44,695.00	39,353.00	26,565.00	10,717.00	36,284.00
Total	$1,534,525.00	$1,351,103.00	$912,065.00	$367,937.00	$1,245,744.00
Cost per kilowatt	$76.73	$67.56	$45.60	$18.40	$83.05

Cost of adding 10,000 kw. at Weleetka station — $250,000.

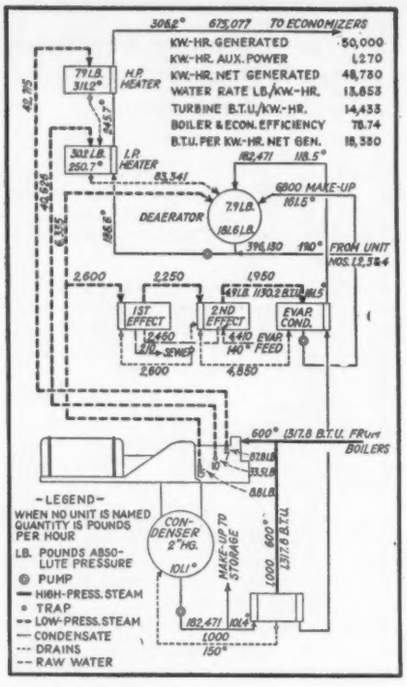
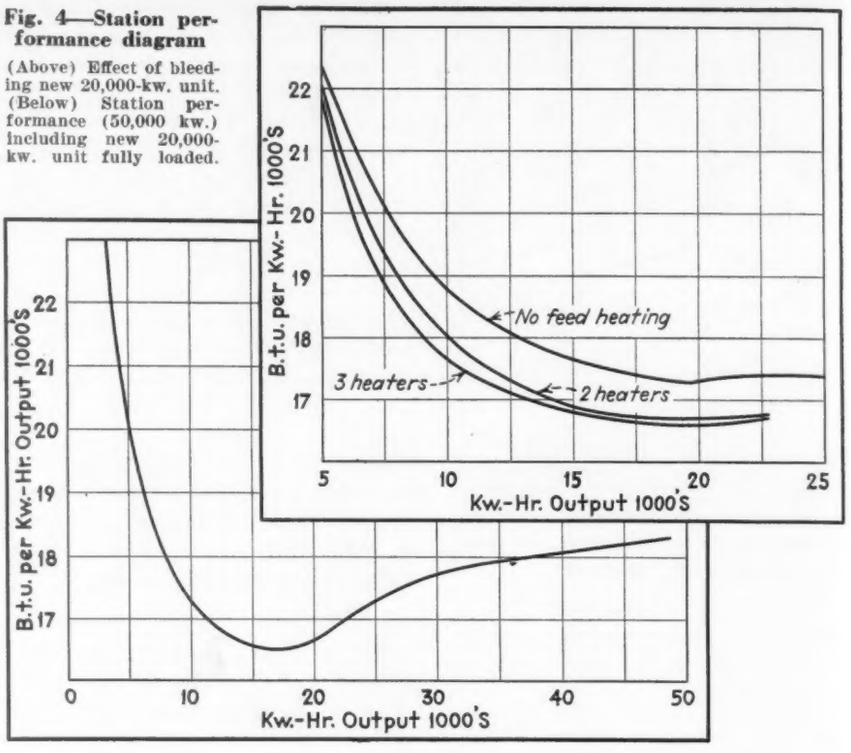


Fig. 3—Station performance diagram for 50,000-kw. load

Fig. 4—Station performance diagram

(Above) Effect of bleeding new 20,000-kw. unit. (Below) Station performance (50,000 kw.) including new 20,000-kw. unit fully loaded.



The condensing water situation constituted one of the major disadvantages of the recommended plan. A spray pond is necessary to augment the limited supply of circulating water for the 20,000-kw. unit added. The resultant operating economy is not as good as could be obtained from a high-pressure unit, but the investment requirements are less.

Performance studied

Performance studies were made for the station carrying 20,000 kw., 30,000 kw., 40,000 kw. and 50,000 kw. (see Fig. 3), the new 20,000-kw. unit carrying full load for each assumed station condition. The performance characteristic of the station is shown in Fig. 4 for loads from 3,250 to 50,000 kw.

A study was also made to determine the number of bleeder heaters that should be used in connection with the unit and the stage location of such heaters for best economy. A tabulation of all possible bleeder points was made and the performance of the unit calculated for all combinations except those obviously uneconomical. The calculations were made from a simplified flow diagram and on the assumption that non-extraction pressures at the bleeder would be maintained when operating extracting. This assumption is not entirely correct, but it gives the relative economy which could actually be obtained.

The bleeding calculations showed that the best economy can be obtained when using three heaters in conjunction with extraction from stages 7, 10 and 15 of the turbine. The performance curve at 50,000 kw. (Fig. 3) was determined on this basis. The best three-heater combination is compared with both no-feed heating and the best two-heater combination in Fig. 4, which summarizes therefore the extended bleeding data computed.

Table III—Load Duration and Fuel Cost of 227,260,000-Kw.-Hr. per Year

Hours Duration	Average Load (Kw.)	Condition No. 1 — Weleetka Station Load Kw.	Weleetka Station Fuel Cost	West Tulsa Station Load Kw.	West Tulsa Station Fuel Cost	Condition No. 2 — Weleetka Station Load Kw.	Weleetka Station Fuel Cost	West Tulsa Station Load, Kw.	West Tulsa Station Fuel Cost
100	45,000	30,000	$2,650.00	15,000	$1,580.00	6,000	$745.00	39,000	$3,518.00
100	44,000	30,000	2,650.00	14,000	1,510.00	6,300	745.00	38,000	3,425.00
300	42,000	30,000	7,950.00	12,000	4,050.00	6,000	2,235.00	36,000	9,780.00
500	39,000	27,500	12,400.00	11,500	6,525.00	6,000	3,725.00	33,000	15,125.00
1000	34,000	22,500	21,500.00	11,500	13,050.00	6,000	7,450.00	28,000	26,250.00
1000	31,000	19,500	19,100.00	11,500	13,050.00	6,000	7,450.00	25,000	23,800.00
1000	29,000	17,500	18,200.00	11,500	13,050.00	6,000	7,450.00	23,000	22,250.00
500	27,000	15,500	8,250.00	11,500	6,525.00	6,000	3,725.00	21,000	10,300.00
1000	24,000	12,500	14,100.00	11,500	13,050.00	6,000	7,450.00	18,000	18,250.00
1000	20,000	8,500	8,500.00	11,500	13,050.00	6,000	7,450.00	14,000	13,100.00
1500	16,000	4,500	8,700.00	11,500	19,575.00	6,000	11,175.00	10,000	17,925.00
500	14,500	3,000	2,100.00	11,500	6,525.00	6,000	3,725.00	8,500	5,325.00
260	13,500	2,000	780.00	11,500	3,393.00	6,000	1,937.00	7,500	2,574.00
			$126,880.00		$114,938.00		$65,262.00		$173,622.00

The conditions 1 and 2 are those detailed for Table II. Note that condition 2 shows ,$2,934 less total fuel cost than condition 1.

Resin Protects Cable Against Oil Migration

By L. I. KOMIVES
Underground Lines Department, Detroit Edison Company

DUE to the design of the cable terminals on outdoor transformers on the system of the Detroit Edison Company it is necessary to train 24-kv., three-conductor underground cables directly into the oil-filled terminal box of the transformers. This construction in the past has led to numerous troubles in the underground cables due to migration of the transformer oil into the cable.

The thin oil used in transformers, having a lower viscosity than the customary cable-impregnating compounds, penetrates the interior of the cable quite readily and acts as a solvent for the cable-impregnating compounds and joint-filling compounds. When certain types of cable-impregnating compounds are mixed with transformer oil the resultant mixture may have a considerably higher power factor than either of its constituents, besides having a lower viscosity curve than the cable-impregnating compound alone. Should transformer oil become mixed with cable compound or petroleum base joint-filling compound, or with the mixture of the two, the increase in power factor is tremendous, even when the joint-filling compound constitutes as little as 0.5 per cent of the mixture. On the system of the Detroit Edison Company breakdowns in cable sections as far away as ten cable sections from the transformer occurred, caused primarily by the high dielectric losses induced by the mixture of joint-filling compound, transformer oil and cable-impregnating compound.

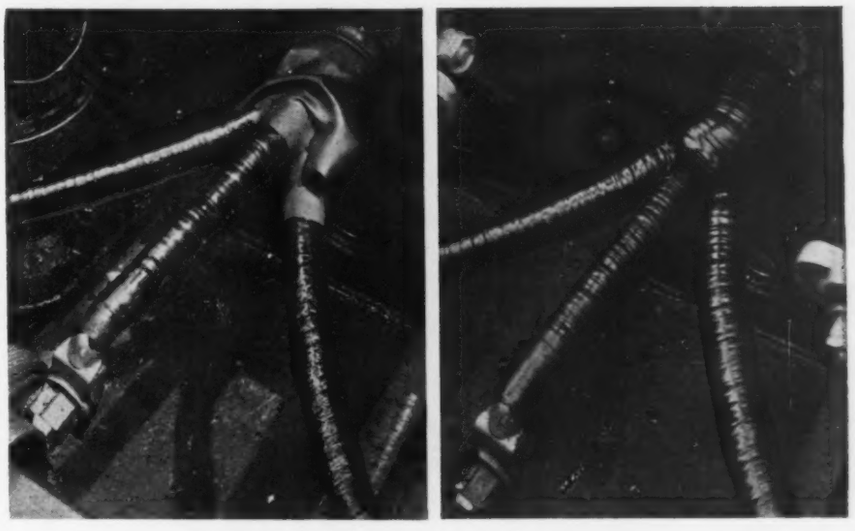
Oil may enter into the cable through any of its constituents, *i.e.*, through the copper conductor if stranded construction is used, through the conductor insulation, filler spaces and belt insulation, in case of belted cable. Cable lugs applied on the ends of the copper conductors can be usually relied upon to prevent the entrance of the oil through the ends of the stranded conductors. It is considered to be a comparatively easy problem to keep the oil out of the conductor insulation by the application of an oil-insoluble covering over the exposed conductor insulation from the "crotch" to the lug. This is usually accomplished by wrapping a number of layers of oil-insoluble tape over the conductor insulation and by applying an oil-insoluble, flexible cementing medium between the layers of tape.

The "Vinsol" compound here described has been found to have excellent cementing properties for such installations. If the cable is terminated in a vertical position, the use of an oil-insoluble compound such as "Vinsol" to fill the base of the terminal containing the "crotch" of the cable would complete the oil-stop as it would bar the way of the oil to the filler spacers and belt if present.

With the cable in a horizontal position, such as encountered on outdoor transformers on the Detroit Edison Company's system, it becomes necessary to devise a holder for the oil-insoluble compound to keep it in position during solidification and at maximum operating temperatures. This holder must also be oil resistant or shielded from the effects of oil, and as such will serve as a second barrier against the oil flow into the cable. An oil-resistant protecting covering for this holder not only shields it against the oil but also serves as a third line of defense against the oil.

The design now generally used for such installations on the Detroit Edison System is shown in the accompanying illustrations.

[*Continued on page 107*]



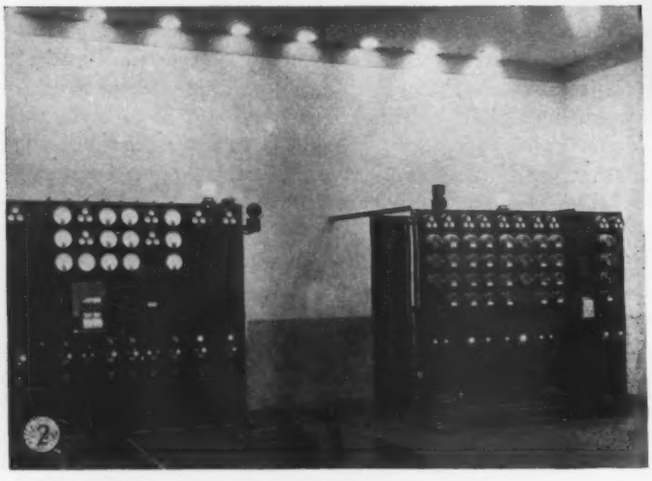
Rubber "glove" holds resin compound

Here is a cable termination in the box, later to be filled with oil, on the side of a transformer. At the left appears the rubber glove drawn over the conductors where they fan out from the cable. The glove is filled with resin compound through the open thumb. Then the glove is taped over to make the finished job shown at the right.

Modern Lighting for Today's Power Plants

High Light Intensities on Vital Working Areas Through Careful Use of Light-Controlling Lens Type Units Mark Modern Switch- and Control-Room Lighting

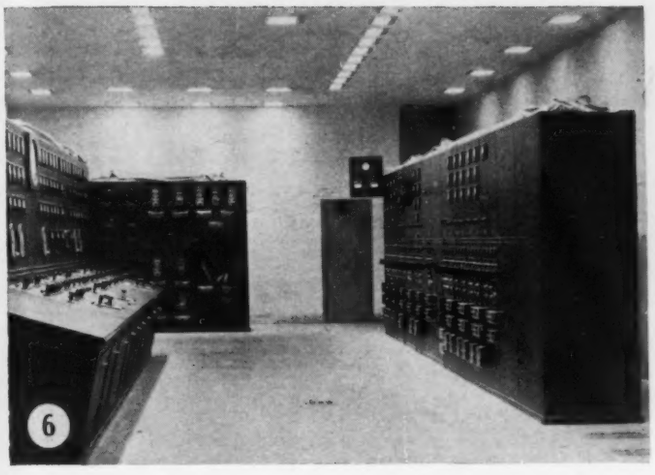
By DAVIS H. TUCK
Electrical Engineer, Holophane Company, Inc., New York

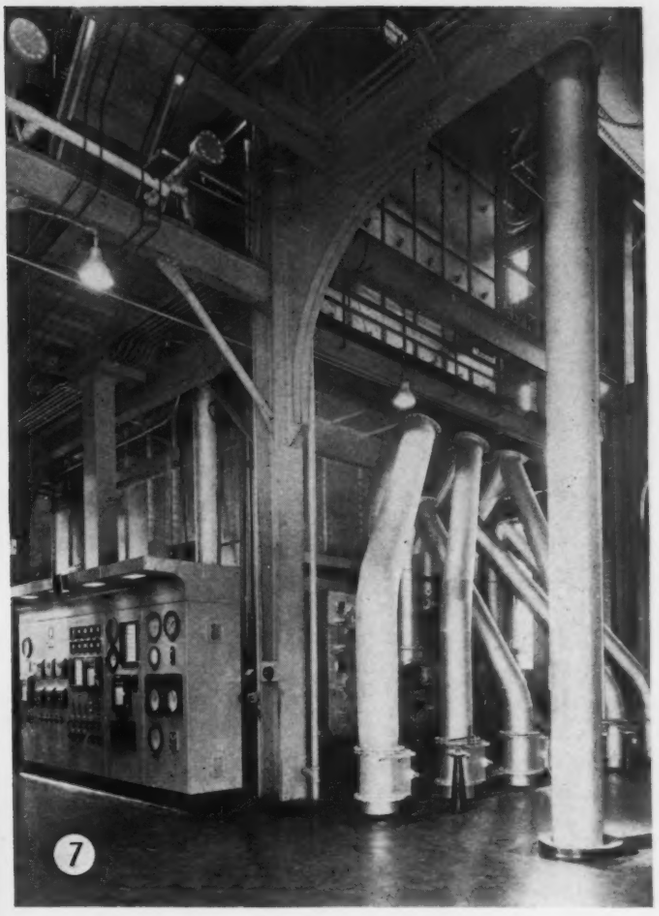


1 Turbine control board at Springdale station of West Penn Power Company is lighted by a continuous trough of controlenses behind a truss

2 Lighting of the control board at the Cumberland, Md., plant of the Potomac Edison Company is accomplished by use of asymmetric controlenses in flush type ceiling units both in front of and in back of the board

3 Deep bowl type reflectors with prismatic reflecting surface are used on the boiler room operating floor of the Conners Creek plant of the Detroit Edison Company, to eliminate glare and facilitate cleaning





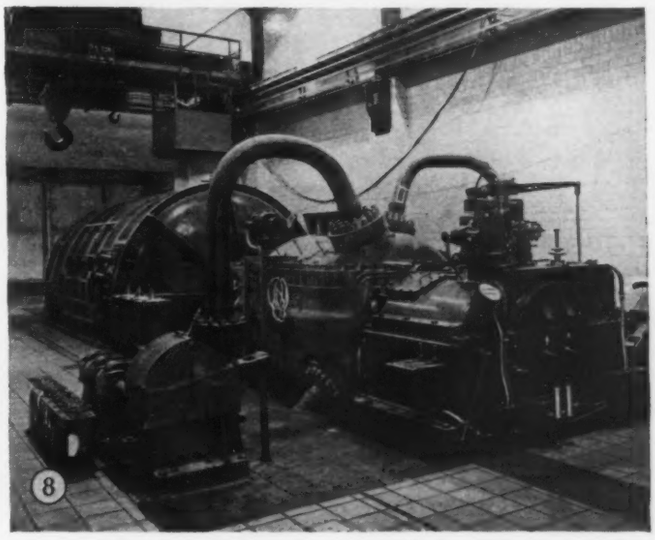
7 An illumination of 25 ft.-candles is secured on the vertical face of this boiler control board at Miller's Ford station, Dayton Power & Light Company, by the use of asymmetric controlenses flushed into an overhanging hood with 150-watt Mazda lamps. They are spaced on 3-ft. centers 1 ft. 6 in. from face of the board

4 First aid room of the Hartford (Conn.) Electric Light Company employs a special luminaire which yields 10 ft-candles for interviewing patients and with controlens uncovered 100 ft-candles on the operating table for examination

5 Automotive maintenance shop of the Department of Water and Power, city of Los Angeles, Calif., lighted by prismatic metal-covered high-bay reflectors with 400-watt high-intensity mercury lamps spaced on 20 x 30-ft. centers 35 ft. above the floor. Illumination on the floor is 15 ft.-candles. Local lighting is available from extension lamps

6 Over the 26-ft. bench board in this new control room of the Pacific Gas & Electric Company, Oakland, Calif., are thirteen asymmetric controlens units housing two 150-watt lamps each and spaced on 2-ft. centers, with the back edge of the lens over the front of the bench. Units are flush in the 12-ft. ceiling. Illumination on the horizontal and vertical faces of the board is about 25 ft.-candles. Back of the board is illuminated by five asymmetric spread type flush controlens units with 200-watt lamps spaced on 8-ft. centers and with the lens centers 1½ ft. from the back face of the board. The front face of the 27-ft. vertical board is illuminated by fourteen asymmetrical flush type controlens units located with the centerline out 2 ft. from the face of the board. Illumination on this board is about 25 ft.-candles

8 Turbine room illumination at Essex station, Public Service Electric & Gas Company, Newark, N. J., is 40 ft.-candles and is secured by prismatic glass metal-covered high-bay units and 1,500-watt Mazda lamps located above the crane



Editorials

S. B. WILLIAMS, Editor

Preferred Standards for Turbines

UTILITY steam plants reflect a considerable amount of individualism in specifications for the turbo-generators, boilers, fuel handling and accessories, etc. Much of it has appeared justifiable because of differences from site to site in available fuel, existing condensing water temperatures and volume, urgency for thermodynamic efficiency, prospective utilization factors, correlation with existing facilities, etc. Putting it very broadly, no two plants have been identical in general design nor have particular major pieces of equipment been duplicated in all particulars.

This practice has been defended not only because it represents optimum efficacy for each situation but also it marks continuous progress toward better power economics. Confronted, however, with the world-wide unrest, it has appeared to the government that a moderate degree of concentration on compromise specification factors would eliminate the greater cost of wholly custom-built units and at the same time expedite the production and installation of power-generating capacity if we should face a defense emergency.

As a result of this study a subcommittee of the National Defense Power Committee, under John C. Parker, A.I.E.E. president, as chairman, has recommended preferred standards for steam turbine generators in considerable detail (see ELECTRICAL WORLD, Nov. 26, page 4). Many designers will undoubtedly find that they can reconcile these preferred units with the situations in which they will have to function. Sacrifices in fractions of economy will result, but it is reasonable to hope that the lesser cost of a standardized line of machines will result in first cost savings offsetting whatever loss in operating economy is incurred.

The industry deserves commendation for its demonstrated ability to move quickly and harmoniously in this desirable direction without at all shutting the door to the specialized design which meets peculiar local needs nor the evolutionary designs that advance the art and promise still cheaper and more reliable power from fuel.

Normal peace-time expansion will in due season benefit by this agreement inspired by war emergency preparations. In fact, there is in prospect the possibility of a price inducement whenever the second turbine is a Chinese copy of the last order. Emergencies can be a boon when they focus attention on practices that otherwise would move far slower toward a common standard.

Now the remaining task is to reduce in similar manner the variegations in steam generator design. But that will take longer merely because more is known about electrical and magnetic flow-paths and even of steam in turbine blading than of hot gas flow in steam generators.

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Residential Load to the Rescue

FURTHER evidence of the stabilizing effect of the domestic load upon utility revenues is afforded by the figures for September operations. Data for the month, which were released this week by the Edison Electric Institute, disclosed that the kilowatt-hour sales were down in comparison with September of last year by 5.3 per cent, but revenue from ultimate customers was off only 1.4 per cent.

The data which cover the entire industry show a loss in sales to every customer classification except residential, and that was up over 10 per cent. Revenue per kilowatt-hour for residential service continued to go lower as the result of rate reductions and increased usage in the lower brackets. Thus, for the twelve months ended September this year the average was 4.27 cents per kilowatt-hour, against 4.46 cents for the same period a year ago. Nevertheless, the continued residential load-building effort has kept the gross revenue very close to the previous September's receipts.

Energy sales durng the last quarters of 1937 fell off rapidly, while the reverse is true this year. The effect upon gross revenues will therefore be such as to make the comparative result for the year as a whole rather favorable.

•

Vanishing Subsidies

A FEW YEARS ago subsidies to customers and to dealers seemed to be the most effective way of moving certain major appliances in both the residential and commercial markets. Today subsidies are on the way out.

In criticising subsidies utility men would do well to keep their minds open if for no other reason than the necessity for keeping sales plans flexible. Times and conditions play an important part in the character of sales programs.

In other words, to criticise subsidies as an admis-

sion that prices are too high might close the door to an important instrument in speeding up certain sales. Some products need starters to gain public acceptance. If a subsidy appears to be the quickest and best means, then why not use it?

There can be no argument to the fact that allowances to customers on wiring and to dealers on sales gave impetus to markets that had for a long time been sluggish. By the same token, similar situations on other products might arise in the future where a quick shot of subsidy would help them to start rolling. While we may as Americans inherently dislike subsidies, we should not close our minds to their effectiveness in times of need.

The important thing is to know when to stop a subsidy. Experiences of several properties seem to indicate that wiring allowances for ranges and water heaters is no longer necessary. And if the time has come to put the wiring cost back on the customer, and it appears that it has, then the same money devoted to intensive promotion of these same load builders should increase the velocity of sales. Unquestionably the cost of subsidies has prevented the utilities from doing all that was necessary to build the market. With money released from subsidies, new activities can be started, such as intensive dealer sales training, more extensive advertising, broadening the character and number of sales outlets.

•

New Horizons for Street-Lighting Business

IF THERE is any single classification of the business which public utility people have treated like a stepchild, it is without doubt the street-lighting business.

And the reasons are not far to seek, for, as the practical utility man knows, a combination of lawyers on one side and politicians on the other can make any business a precarious business. Thus, the first instinct of the typical utility man with an engineering and sales background has been to shy away from the street-lighting jobs. Even when the business has been added to the lines it came on with the residential lighting peak, was sold at a low rate when lamp renewals and replacements, cleaning and patrolling were included. Finally, in times of trouble, the business had a distinct tendency to become slow pay or no pay, and yet the utility did not wish to invoke its power to cut off street lighting service to the people.

The advent of better times has vastly improved the standing of street lighting and the larger cities and counties and some states are vigorously prosecuting further development of the business. One of the latest developments in this field probably is the program now under way in West Penn territory. As described in this issue, it is a long-range plan for building, holding and increasing street-lighting load and revenue, with the utility supplying the leadership. The market is mapped, the prospect's needs and capacity to pay are analyzed and weighed, the drawbacks of the past are unearthed and they are used as *specific* means of getting street-lighting agreements signed.

The story is of business gained from cities that are small and not overly prosperous. To them this story points the way to new horizons for more and profitable street-lighting business.

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Opportunity for Utility Sales Organizations

ONLY a few years ago a great change took place in the utility business. Some plants that were built stood idle, large loads evaporated in a business depression and at the same time a punitive and damaging political attack on a national scale jeopardized the entire national utility structure.

It was under these new circumstances that utility selling began to assume a new importance. More and more, management has turned to its sales forces to provide the income that keeps the gross from drooping so that increasing expenses and taxes may be met and yet cover fixed charges, so that reserves will be created and something left for the stockholders.

The new scope and new responsibility have taught utility sales forces many lessons. The single great lesson which many sales people still must learn is that their job is primarily a management job. The sales manager who considers his sole job is to sell an appliance is selling himself down the river. The sales manager who considers his job is merely to spend his budget appropriation is writing himself off as an expense item, and his whole department with him. When times are bad, and selling is most urgently needed, this sales manager goes out the window.

By the proper balance of sales and promotion, of major and minor appliances and lighting in all classifications of the service, by a proper co-ordination of the objectives and efforts of all selling agencies and by constant attention to the ultimate management goal of all utility sales operations the sales people of our industry will render a distinguished service to themselves, to their managements, their companies and their industry.

Not the least of the services will be selling the company through the sale of its services, and thus a second profit—solely needed in this day and time—will be chalked up to the everlasting credit of these people who spend their lives securing the dollars it takes to run a utility company today.

The Income Tax Return Mystery

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

WHEN Franklin D. Roosevelt was at the age at which pedagogues agree impressions are most vivid and lasting there was a popular song (songs lasted longer in those days) in which two of the lines were:

It may be all right to dissemble your love,
But why did you kick me down stairs?

The recurrent reports of "peace" between the Administration and the power industry, which seem somehow or other always to be accompanied or closely followed by unfriendly New Deal actions toward the utilities, bring this old song to mind. Right on the heels of conferences between the President and high Administration officials with important figures in the electric industry, which left those executives some with hope and some with conviction that the cruel war was over, came the income tax return mystery. It is worth exploring for a moment, for the whole story has not been told in print.

Who ordered what?

First—The executive order issued by President Roosevelt requiring the production, for examination by investigators of the Congressional TVA investigating committee, *all* corporation and personal income tax returns connected with *all* the electric utilities in the United States, went into effect before a single one of the ten senators and representatives on the committee knew anything about it.

Actually, Chairman Vic Donahey, when minority members of the committee started to protest at an open meeting, took full responsibility, took it, in fact, with some heat. But he was careful *not* to say that he had authorized it *in advance*. In fact, his heat was suspected in some quarters to be due to the fact that he felt he had to back up the committee counsel, but did not like it.

Second—Even Francis Biddle, counsel for the committee, at whose instance an executive order was issued, professed surprise at its scope. He produced a copy of the original request for the order, addressed to Secretary of the Treasury Morgenthau, asking merely for the corporation income tax returns of the Tennessee Electric Power Company. He insisted, in reply to criticisms from Representative Wolverton and Jenkins, that there was no intention to use any other returns.

Wolverton insisted that the mere fact the committee's investigators were permitted to look at the returns was an unwarranted assumption and authority and prying into affairs which Congress had insisted should remain under a seal of secrecy. Representative Jenkins, who as a member of the House ways and means committee is familiar with the history of Congressional action on this subject, insisted that the whole intent of Congress was being twisted in this instance.

Jenkins also made the point that the resolution creating the special TVA investigation did not authorize it to inquire into negotiations between privately owned utilities and either the TVA or local governments seeking to purchase the plants. There are 22 subjects of inquiry outlined in the resolution creating the committee, he pointed out, but this is not one of them. Hence, he insisted, to start down a new alley of investigation, long before the others have been thoroughly explored, would hardly seem to be expediting the investigation.

But Wolverton got nowhere in his demand to know why or by whom the scope of the executive order had been expanded, from just the Tennessee corporation's report to all utility, both corporation and individual reports. Biddle could not imagine, he said. Obviously it was done either by the Treasury or the White House.

Extraordinary power

There is still no explanation. But it is at least interesting to recall that this committee, being strapped for funds through some mysterious shenanigins in the closing days of the last Congress, is using experts and investigators from other divisions of the government, and that some of Biddle's investigators, *never* employed with the approval of the committee when the minority members were present, were loaned by WPA. So that it would take a very credulous person indeed to be confident that there was not something very interesting about this surprising grant of a hundred times the power asked in the official request.

Chairman Donahey closed the discussion by banging his gavel and shouting:

"It is perfectly proper that these utilities be brought in here and made to show anything any member of the committee or its counsel wants to find out. I am going to continue that policy both as to the utilities and as to TVA."

Which of course, however, does not explain why the White House granted more power than any member of the committee had thought about, or the counsel had asked in his formal letter!

The dissembling of love was also visible, as through a glass, darkly, when Wendell L. Willkie, head of

[*Continued on page* 104]

News OF THE WEEK

Tentative Plans of Integration Filed With SEC by Utility Units

Leading holding companies comply with request of Chairman Douglas to outline proposals to meet requirements of act — Government to allow time for more comprehensive plans — Industry seen co-operating

First steps toward geographic integration of public utility holding company systems and simplification of corporate structures were taken this week as the industry complied with the provisions of the utility act by filing tentative integration plans with the Securities and Exchange Commission.

In view of the substantial response of the industry to the suggestion of SEC Chairman William O. Douglas that holding companies submit tentative plans by December 1, there is no disposition by SEC officials to forecast any immediate action against those companies that failed to meet the deadline by filing comprehensive plans.

Need more time

SEC officials pointed out that because of the complexity of the problem many companies needed more time to put their plans in shape and that ample latitude will be extended to all companies that have displayed the slightest inclination to co-operate with the government. It is realized that conferences must be held at later dates with the companies so that solutions to the problems can be worked out. In many cases plans of one system affect other systems and mutual understanding and co-operation are necessary in the swapping of properties to bring about geographic integration.

Last week Engineers Public Service Company answered the request of Mr. Douglas for a tentative plan of integration. Cities Service Company filed its plan of integration for the utility properties held by Cities Service Power & Light.

SEC announced that East Tennessee Light & Power Company had filed a plan of reorganization under the utility act to simplify the corporate structure of its holding company system through the elimination of its subsidiaries, Tennessee Eastern Electric Company and Tennessee Realty Company.

Some time ago North American Company and United Light & Power filed their plans of integration, as did United Corporation and the two Harrison Williams investment trusts—Central States Electric Corporation and American Cities Power & Light Corporation. This week Central States Electric and American Cities Power & Light sold to Tri-Continental Corporation and Selected Industries, Inc., approximately 78 per cent of the outstanding common stock of Electric Shareholdings Corporation in exchange for common stock of Blue Ridge Corporation. American Cities also sold to Electric Shareholdings all its holdings of common stock of Tri-Continental in exchange for Blue Ridge.

The last-minute rush to complete tentative integration plans swelled the number of utility holding companies to answer the letter of Mr. Douglas. Commonwealth & Southern sent its tentative plans this week.

In considering plans of system integration, holding company officials stress the point that a major consideration is the employees in the operating units and the customers. It was said that nothing is contemplated which would disrupt operations of the subsidiaries.

A comprehensive plan was filed by Associated Gas & Electric which proposes establishing a Middle Atlantic system and a southern group of operating units. It plans to eliminate 112 com-

COMMERCIAL ROUND-UP—New England Power Engineers Association and Lighting Engineers Club of New England staged a commercial round-up at Boston last week. L. to r., seated—R. L. Smart, Boston Edison, chairman of light group; C. M. Snyder, General Electric lamp division, and Julius Daniels, sales manager of Boston Edison. Standing—C. I. Dwinell, Cambridge Electric Light; H. E. Ayers, Lynn Gas & Electric, and John McMaster, Plymouth County Electric

panies which would reduce the number in the system to 60.

American Gas & Electric filed a "formal" plan of integration forming the "Central System," the "South Jersey System" and the "Northeast Pennsylvania System." This plan is independent of the Electric Bond & Share plan.

•

Utilities Get Praise for Work in Storm

Representatives of government and industry were high in their praise of the splendid work of the public utilities in meeting the emergency created by the hurricane which swept the Atlantic seaboard last September.

George C. O'Neill, head of the operating forces, Woburn district, Boston Edison Company, received the thanks of New England as a representative of the power industry at the recent New England Conference in Boston, for services rendered during the hurricane period. In the presence of governors, federal officials and more than 500 business leaders, representatives of public utilities, civic, business and relief organizations were publicly thanked for their devotion to the common welfare during the time of stress.

Citations were presented to 23 agencies. The power industry accolade read:

"New England's electric light and power companies performed heroic service not only in the days following the disaster but even in the midst of the hurricane itself. Warned by high winds, George C. O'Neill, already on duty, organized his forces on an emergency basis, and was able to save a main transmission line on which many communities depended. In his resourcefulness and his ability to work long hours he typifies the spirit of the forces of all New England's electric light and power companies."

Offers Distribution Facilities to City

New Brunswick Power Company, St. John, N. B., has notified the City Council of its willingness to sell to the St. John Power Commission the electric light and power distribution facilities of the company. The power plant, electric railway, gas plant and buildings owned by the company are not to be involved in the offer.

The company asked that the Council arrange for negotiations with the company on such sale as outlined by W. P. Southard, vice-president and general manager of the company, which is a subsidiary of the Federal Light & Traction Company. The St. John Power Commission recently executed a contract over a fifteen-year period with the New Brunswick Electric Power Commission for a supply of energy from the Musquash hydro development, 15 miles west of St. John.

Three years ago negotiations were started between the New Brunswick Power Company and the City Council of St. John, with a view to sell all the assets of the company to the city for $3,250,000. The negotiations fell through. In explaining his offer, Mr. Southard stated that substantial economies could be attained.

•

Rate Finding Due Soon

Following a study of a report on Rhode Island electric rates by Frederick A. Young, former public utility commissioner, Michael DeCiantis, chief of the state Division of Public Utilities, will shortly announce proposed reductions to the operating companies of the commonwealth.

In the recent gubernatorial campaign Governor Quinn, who was defeated at the polls, asserted that reductions aggregating $1,500,000 per year were anticipated, but that delay in making them effective resulted from severe hurricane losses and genuine contributions to public service in restoring facilities.

Mr. DeCiantis states that if the operating companies agree to the proposed cuts he will make them public, but if not, hearings will be held before ordering them into use.

•

Gray Is Named Head of Electric Leagues

A constructive program, including discussions on lighting, wiring, appliance promotion and merchandising legislation, was presented at the third annual conference of the International Association of Electrical Leagues, held recently in Philadelphia.

Representatives of manufacturers, utilities, wholesalers and contractors, in addition to members of the league from all parts of the country, took part in the three-day discussion. C. K. West, president of the Electrical Association of Philadelphia, welcomed the delegates.

H. P. Liversidge, president of Philadelphia Electric Company, urged cooperation among the various branches of the electrical industry. He declared that while the various branches of the industry are interdependent it was good policy to know the problems of the other. He pointed out that everything that affects one branch has its repercussions on the other branches. "It is, therefore, good business for the industry to work together and, by so doing, it helps customer relations."

Officers elected included A. A. Gray, manager of Electric Association, Chicago, president; G. W. Weston, secretary-manager Electric Association of Kansas City, Mo., vice-president, and J. S. Bartlett, managing director of Electric Institute, Washington, D. C., treasurer. George R. Conover, Jr., of Philadelphia, retiring president, was elected as an advisory member of the board of governors.

NEW ENGLAND MEETING—Representatives of government and industry who received the accolade of public service in the September storm emergency from the New England governors at recent fourteenth annual meeting of New England Conference

Willkie Hits U. S. Loans to Force Sale of Private Utility Facilities

Tells Congressional committee investigating TVA that TVA-PWA "alliance" forces sale at unwarranted low price — Terms procedure "un-American and brutal"— Suggests that SEC determine value

Public attitude toward TVA, the government's social experiment in the power business, and its competition with private utilities is likely to make itself felt as a result of the investigation now being carried on by the joint Congressional committee.

Last week Wendell L. Willkie, president of Commonwealth & Southern, the system which stands to lose most as a result of TVA expansion, struck vigorously at the manner in which the TVA and other governmental agencies have sought to force the sale of the system's properties at an unwarranted low price. He termed the procedure "one of the most cruel, most brutal and most un-American doctrines ever adopted by any government."

Grants affect price

Referring to PWA grants of 45 per cent to municipalities to duplicate present facilities, he said that this method had the effect of either forcing the power companies to sell at the municipalities' price or of rendering the property of the private utility worthless.

Mr. Willkie offered a solution to the present situation. He declared that if the government was out to own all the utilities, then it should pay a fair price for the properties and not destroy savings of investors. To accomplish this end Mr. Willkie offered to sell his Tennessee Electric Power Company at a price to be fixed by the SEC or some qualified arbitration board. He suggested the SEC because, he said, the government agency was well qualified, with its experts, to determine valuations.

Protesting the "alliance" between the TVA and PWA, Mr. Willkie told the Congressional committee that the threat of duplication of utility facilities with government funds weighs heavily in every negotiation. He warned that nothing could bring new capital into the industry as long as TVA and PWA were allowed to continue "unrestricted." He predicted that national recovery could be expedited by a $2,000,000,000 expansion in utility investment if the committee would curb the two government agencies.

This week L. J. Wilhoite, chairman of the Chattanooga Electric Power Board, denounced as untrue the statement by Mr. Willkie that the city of Chattanooga was acting in concert with the TVA and the PWA to force him to sell his Tennessee property at less than a fair valuation. Mr. Willkie had told the Congressional committee that the PWA stands ready to advance Chattanooga 45 per cent of the necessary funds to build a duplicate system.

Replying to Mr. Wilhoite, it was stated by Mr. Willkie that "without a free gift from the PWA of 45 per cent of the money for a duplicate utility system and without a loan of the balance at low interest rates and without the offer of government-subsidized TVA power the citizens of Chattanooga would not have voted for a municipal system, and the Chattanooga Power Board would not now be attempting to force the sale of our properties under pressure."

Mr. Willkie said that "Mr. Wilhoite's statements and actions are characteristic of that arrogance which is so apt to mark a man who has the power of free government funds."

Attack TVA accounting

This week the TVA came in for an attack from a government source when R. N. Elliott, acting comptroller-general, told the committee that the TVA has assumed the position of not being amenable to provisions of law and regulations governing audit and settlement of the authority's accounts by his office. He charged that the accounting practices of TVA in certain phases are "very unsatisfactory" and that TVA refused to submit necessary accounting data to his office.

Reports indicate that Dr. Arthur E. Morgan, former chairman of TVA, may be called to testify before the committee.

Observers in Washington are closely watching public reaction to the present Congressional investigation for possible signs of demands for Congress to take action on TVA matters and the entire government power program.

•

Rejects Private Properties

The Lower Colorado River Authority has refused to buy Texas Power & Light Company properties in sixteen south Texas counties in which the authority operates. Operations Manager Max Starcke of the authority announced that the utility company asked $7,300,000 for the holdings, but that the authority was willing to pay only $4,000,000.

•

Assails PWA Project Sign

The sign which the PWA is displaying on projects which are duplicating the facilities of Alabama Power Company came under sharp attack from the company in newspaper advertising. The utility states that the "Federal Emergency" phase "would be more truthful were it to read 'Federal propaganda.' Where was any 'emergency' in Alabama requiring the erection of duplicate electric systems?"

Wide World

AT INQUIRY—Senator-elect James M. Mead of New York and vice-chairman of the congressional committee investigating TVA (left) and Wendell L. Willkie, president of Commonwealth & Southern, as they appeared at the hearing last week in Washington

Municipal System Assured City as PWA Advances Power Funds

Administrator Ickes says pending grant of $126,000 to Columbus, Miss., for distribution system is now effective because Mississippi Power has rejected purchase offer — LCRA rejects Texas utility offer

Government subsidized competition with private utilities may assume less importance as time goes on and public opposition manifests itself, but where an opportunity presents itself for spreading PWA grants and loans for a competitive system the most will be made of it.

Last week such an opportunity existed and Administrator Harold L. Ickes applied his new policy of utility competition by announcing that funds for the construction of an electric distribution system will be advanced to Columbus, Miss., because the Mississippi Power Company, Commonwealth & Southern subsidiary, has refused the city's offer to buy the existing facilities.

Money made available

Mr. Ickes said that a pending grant of $126,000 to Columbus for a municipal system is now effective. Money will immediately be made available to the city for preliminary expenses.

Reviewing the efforts of the city to purchase the existing facilities, Mr. Ickes said that on July 7, 1938, Columbus was given a PWA grant of $126,000 to apply on purchase of the facilities. The city then offered the utility $232,000 for the system, which serves 2,500 customers. Mr. Ickes said that the power company refused this offer and in turn had asked $536,366.

When agreement on the purchase price could not be reached both sides filed briefs with Mr. Ickes. After considerable investigation, it was said, the administrator reported to both parties that in his opinion a fair offer for the purchase would amount to $269,000. This figure was accepted by the city and then an offer made to Mississippi Power, but it was rejected. Now the PWA considers that the "fair offer" has been rejected and is free to make the allotment. This is in line with the new policy agreed to by Senator Buckley that no PWA money be made available for a competitive system until a utility had refused a fair and reasonable offer for its properties. PWA is the judge of what is a fair offer.

Two cities negotiating

Two cities—Vandalia, Mo., and Smithville, Tex.—have had such offers accepted and are proceeding with purchase agreements. Other decisions must be made in the near future, since the appropriation act provides that actual construction of PWA projects under the current program must be started not later than January 1, 1939.

Reports have been received that the Lower Colorado River Authority has definitely refused to pay the price of $7,300,000 set by Texas Power & Light Company for the purchase of its facilities in sixteen South Texas counties to be served with power from the authority's four power and flood control developments on the lower Colorado River.

Officials of the LCRA state that their top price is $4,000,000. PWA has not only financed the authority's construction program but has also approved loans and grants to eight towns in the area for the construction of distribution systems.

•

Boston Installation Fees Face Possible Increase

Electrical installation fees required by the city of Boston may be increased substantially if the head of the wire department puts into effect recommendations of the revenue survey committee to Mayor Maurice J. Tobin. These fees are paid to the wire division, and in general the proposed increases range from 25 cents to $1, and apply to motors, neon signs, generators of 10-kw. rating or less, and above 10 kw., and transformers above and below 10 kva.

•

EHFA Lets New Wiring and Appliance Contracts

Electric Home and Farm Authority has announced that contracts have been closed with the city of Worthington, Minn., which operates a municipal utility; Illinois Rural Electric Company, Winchester; Nobles Co-operative Electric, Worthington, Minn.; Snapping Shoals Electric Membership Corporation, Covington, Ga.; Dunn County Electric Co-operative, Menomonie, Wis., and the McLeod Co-operative Power Association, Glencoe, Minn. Contracts cover the financing of electrical appliances.

Contracts have been closed also with the Iowa Electric Light & Power Company; Planters Electric Membership Corporation, Waynesboro, Ga.; Sumter Electric Co-operative Association, Inc., Bushnell, Fla., and the Illinois Rural Electric Company, Winchester, Ill. The contracts provide that EHFA and the utilities will co-operate in financing the wiring or rewiring of existing homes and farms located on the utilities' lines.

•

Chicago Utility Plans Expansion of Plants

Capital expenditures totaling approximately $75,000,000 are being contemplated by the Commonwealth Edison Company group over the next two years, according to James Simpson, chairman. Mr. Simpson declared that $14,000,000 from funds now being raised by the sale of new securities has been reserved for the construction of additional producing facilities.

"With confidence in the future of Chicago and the surrounding outlying area," Mr. Simpson said, "it is estimated that in the next two years $75,000,000 in capital expenditures may be necessary to meet increasing demand."

In a published report to more than 1,300,000 customers and 80,000 stockholders and the many bondholders and employees of the company, Mr. Simpson pointed out that it is an obligation of management to publish periodic reports on the operation of businesses in which the public has a vital interest. He said that since May, 1938, a total of $224,000,000 of securities has been sold to the public. This is part of the refunding program of the company to simplify its corporate structure and to redeem all outstanding securities of subsidiaries.

•

Agency for G.E. Workers

The NLRB has certified United Electrical Radio and Machine Workers of America as sole collective bargaining agency for employees of the Newark lamp warehouse of General Electric, Newark, N. J., excluding supervisory, office and salaried workers, teamsters, chauffeurs and drivers, part-time platform men, mechanics and truck drivers.

•

Wiring Meeting Held

At a joint meeting held recently the Electrical League of Rhode Island and the Providence Architectural Club discussed "The Value of Adequate Wiring." Henry R. Tracy, president, and Harry E. Dawson, secretary of the league, and A. C. Tait, field representative of the National Adequate Wiring Bureau, were speakers.

State Group Fights St. Lawrence Plan

Prospects of the St. Lawrence becoming a valuable utility asset are less than at any time since its public development was first proposed, a report issued by the New York State Chamber of Commerce declared recently. The study was prepared by the Committee on Internal Trade and Improvements.

The chamber went on record on October 7, 1920, in opposition to the St. Lawrence development and since then has opposed repeatedly adoption of a treaty with Canada which would make possible the use of government funds to construct the seaway from the Great Lakes to the ocean and build government power plants along the river.

"Recently again the Administration at Washington has indicated its desire to undertake this project," the report continues. "The United States would agree to advance the funds for the construction in Canada, the latter to repay the cost in or before 1949 . . . In view of these considerations your committee believes the chamber should again record its belief that the great expenditure of public funds contemplated on the St. Lawrence cannot be justified on any ground whatsoever."

•

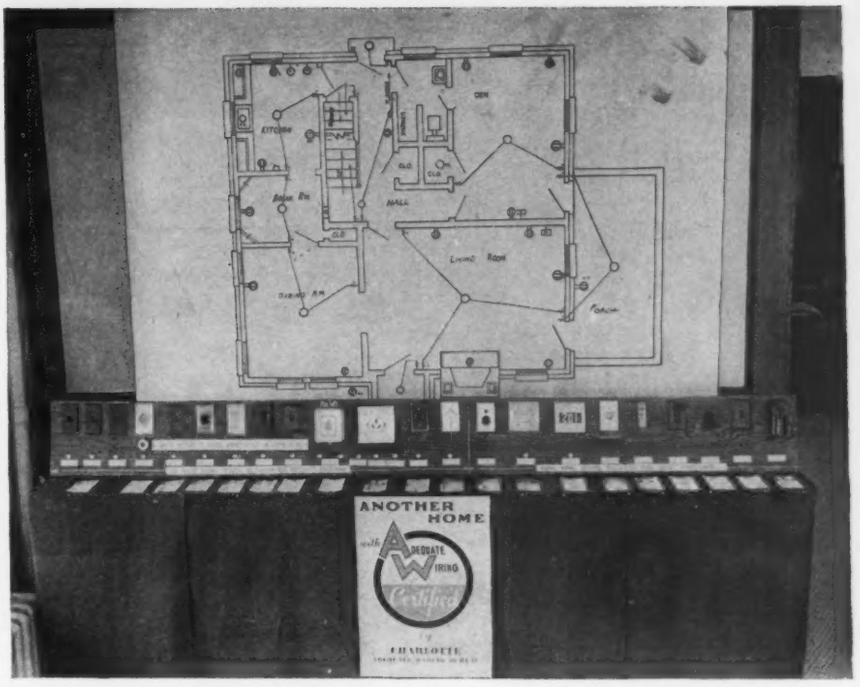
Idaho Power to Make an All-Electric City

Pocatello, Idaho, as an all-electric city is the anticipation of Idaho Power Company, which hopes by December to abandon service from its gas plant there. Affected are some 1,000 gas customers.

Preceding inauguration of the changeover, now under way, a crew of four, headed by Earl Olson, interviewed every Pocatello gas user. Each was given a coupon guaranteeing $40 to $50 credit on his gas range when turned in on an electric unit. (Ranges 1 to 3 years old $50, three to seven years $45, over seven years, $40). Each gas range eligible for trade-in was so tagged.

Dealers co-operated to maintain standard prices for the period and to prevent an influx of fly-by-night opportunists. In connection with gas refrigerators and water heaters, a special adjustment was made for each customer, depending upon age of equipment. Involved were 122 refrigerators.

So well had the merits of electrical usage been pre-developed that enthusiasm for the proposal was almost unanimous.



ADEQUATE WIRING ILLUSTRATED—This display board on the sales floor of the Charlotte, N. C., branch of Duke Power Company helps the customer visualize what adequate wiring means to him. Opposite each wiring device is a push button; when this button is pushed a light shows through the floor plan, back of the corresponding symbol

PWA Allots Funds for Power Projects

With the allotment of funds to 115 non-federal projects on November 19 the PWA virtually exhausted the appropriation granted it by the last Congress. As of that date PWA had left only $104,526 available for non-federal allotments and $793 for federal projects.

Included in the final list of approvals was $458,922 for electric distribution systems in eight Texas towns which are to purchase wholesale power from the Lower Colorado River Authority. Six of these municipalities are now negotiating with the Texas Power & Light Company for purchase of existing facilities, and the PWA money will be held up pending the outcome of these negotiations. Construction, however, must be started not later than January 1, 1939, under the provisions of the relief appropriation bill.

Details of these allotments are:

City	Loan	Grant	Estimated Total Cost
Llano	$38,000	$31,090	$69,090
Kyle	12,000	9,820	21,820
Lampasas ...	42,000	34,363	76,363
Fredericksburg	55,000	45,000	100,000
Bastrop	32,000	26,181	58,181
Burnet	27,000	22,091	49,091
Marble Falls.	18,000	14,727	32,727
Luling	.....	52,650	117,000
Total $224,000		$235,922	$524,272

Other recent power allotments include a grant of $15,975 to Portland, Tenn., for a distribution system to use TVA power and a supplementary allotment of $2,383,000 (of which $1,744,000 is a loan and $609,000 a grant) to Greenwood County, South Carolina, for the construction of the Buzzards Roost hydro-electric plant. Federal funds assigned to this project now total $5,235,000. The Buzzards Roost project furnished the test case upon which the Supreme Court upheld the validity of PWA participation in municipal power activities.

•

Receives Appliance Order

Complete electric kitchens continue to gain favor with housing authorities, as indicated by the number of projects adopting this service. Recently the Olentangy Village Housing Development in Columbus, Ohio, ordered 806 refrigerators and ranges from Westinghouse Electric & Manufacturing Company. The company announced this week the receipt of an order for 69 refrigerators, ranges and water heaters at Emory Court, Atlanta, Ga.

•

Arkansas Plant Expansion

As the initial step in a $235,000 expansion program, the board of directors of the Jonesboro, Ark., municipal water and light plant have awarded contracts for $135,000 worth of equipment, including a new 3,000-kw. turbine, a new generator, condenser and switchboard.

Joint Accounting Meeting to Be Held

Plans for the second National Accounting Conference of the electric and gas industries, to be held under the joint sponsorship of the Edison Electric Institute and the American Gas Association, have been completed. The conference will be held at the Palmer House, Chicago, December 12–14.

The general session of this year's joint conference will be confined to matters relating to the broader aspect of accounting in the gas and electric industry. The principal themes are to be accounting economies, ethics and accounting personnel training and depreciation and plant accounting problems.

Speakers of national reputation, representing government regulatory agencies, as well as the educational, engineering and the manufacturing phases of the business, will address the conference.

•

EHFA Extends Purchase Plan to Appliance Dealers

More than 190 electrical appliance dealers in Chicago have been authorized by Electric Home and Farm Authority to extend the terms of the EHFA purchase plan to their customers, according to E. F. Fleming, Jr., EHFA district manager.

Under this plan electrical appliances may be purchased with down payments as low as 5 per cent, and with subsequent payments over a period of as much as 36 months on one appliance or 48 months on two or more. Wiring modernization in single- or multiple-family dwellings may be financed over a period of 24 months, with down payments as small as 10 per cent. In every case the unpaid balance must be $40 or more.

EHFA terms are available through electrical appliance dealers and electrical contractors who have been authorized by EHFA. The plan, at present, is limited to the area within Chicago's corporate limits.

•

Seeks to Oust Co-operative

Residents of Flowerfield, Mich., an incorporated village, just north of Three Rivers, have filed a petition in Circuit Court at Centerville for a restraining order and a permanent injunction against the Fruit Belt Electric Corporation, a co-operative organization. The petition seeks authority to keep the co-operative from doing business in the village, claiming that it "invaded their territory and erected during the night poles and wires without permission or a franchise to give service to the inhabitants of the village." The petition asks removal of all poles and lines built by the co-operative in Flowerfield and vicinity.

•

Fire at Municipal Plant

Nashville, Tenn., turned to a private utility to furnish it with electric energy when the municipal power plant was disabled as a result of a fire last week. All municipal facilities, including street lights, were plunged into darkness when fire gutted the municipal plant. Jo C. Guild, president of Tennessee Electric Power, offered facilities of his plant to provide service to the city.

•

Home Service Advisers to Join in Sales Work

Montana Power Company's home service advisers will sell for the first time this fall. Leroy Comstock, sales manager, says half their time will be devoted to home lighting and sale of I.E.S. lamps, while the regular sales crew will not sell lamps, but confine its efforts to refrigerators, ranges, water heaters and dishwashers, the only other appliances sold by the company. Although contemplating no lamp bulb campaign this fall, the companv will co-ordinate its promotion with General Electric's "light-conditioning" dealer plan.

Meetings

American Society of Mechanical Engineers—Annual meeting, New York, N. Y., December 5–9. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Thirteenth National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, December 5–10. Charles F. Roth, manager, Grand Central Palace, New York.

Edison Electric Institute-American Gas Association—Second annual accounting conference, Palmer House, Chicago, Ill., December 12–14.

American Association for the Advancement of Science—Winter meeting, Richmond, Va., December 27–31.

American Engineering Council—Annual meeting, Hotel Mayflower, Washington, D. C., January 12–14. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

American Society of Heating and Ventilating Engineers—Annual meeting, Pittsburgh, Pa., January 23–26. A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y.

National Electrical Manufacturers Association—Mid-Winter Conference, Waldorf Astoria Hotel, New York, February 5–11. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

Heating Engineers Plan Annual Meeting

Announcement has been made that the annual meeting of the American Society of Heating and Ventilating Engineers, to be held at Pittsburgh, Pa., January 23–26, will be in the nature of an observance of the twentieth anniversary of the establishment of the society's research laboratory, which occurs in 1939.

Special emphasis at the technical sessions will be laid on research problems. These will include such topics as air conditioning in industry as related to health of workers, hospital air conditioning, characteristics of reflective insulation materials and the heat requirements of single and double glazed houses.

There will be a special symposium devoted to the application of solid fuels in heating and air conditioning.

•

Names Power Study Group

The Twentieth Century Fund, a research organization founded and endowed by the late Edward A. Filene, Boston merchant, has announced it was starting a study of the relation of government to the electric light and power industry. J. Henry Scattergood, formerly public service commissioner of Pennsylvania, has agreed to act as chairman of the special committee making the study.

•

Free Football for Dealers

Mississippi Power & Light Company is awarding 50 free trips to the Sugar Bowl football game at New Orleans on New Year's Day to dealers who show the greatest percentage of sales during the last quarter of the year over the similar quarter of 1937. Dealers entered in the contest are requested to file weekly confidential sales reports with the utility so that a count may be kept on the results.

•

Rural Plan Authorized

New York State Electric & Gas Corporation has been authorized by the state Public Service Commission to issue not to exceed $100,000 aggregate face amount of evidences of indebtedness in payment for not less than a like aggregate amount of refundable advances made or to be made by consumers under a customer finance plan for the construction of three-phase rural electric line extensions as provided for in the corporation's electric rate schedules filed with the commission.

Output Sets Record for Holiday Week

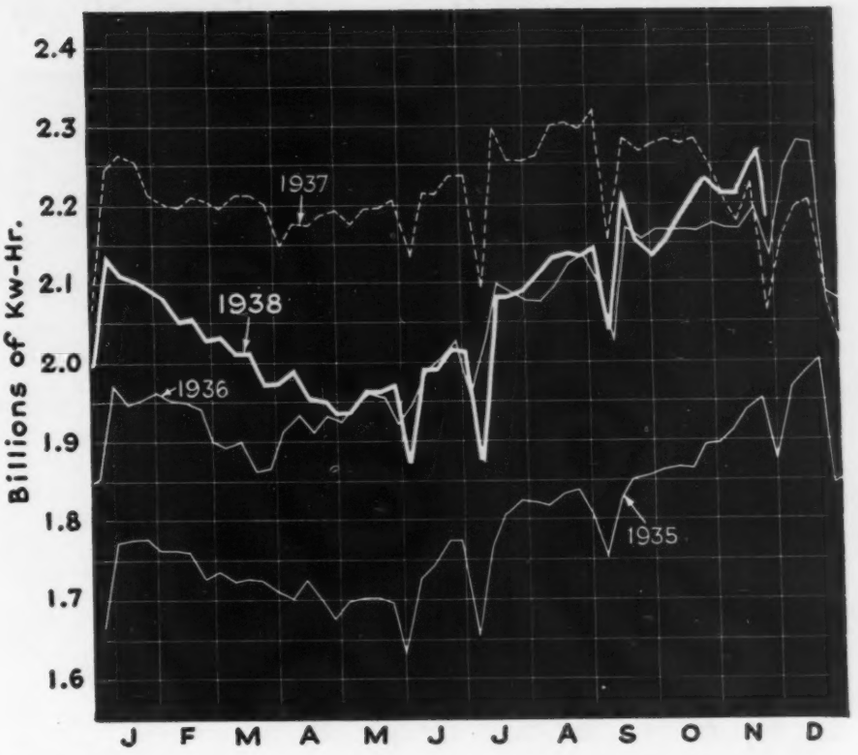
Production of 2,183,807,000 kw.-hr. during the week ended November 26, as reported by the Edison Electric Institute, constituted a new record for the week including Thanksgiving. The excess over 1937, which appeared for the first time at the beginning of November, has increased week by week and now amounts to 5.7 per cent. This widening margin reflects the combined effect of the present upward trend and the abnormal decline a year ago.

The holiday sag compared with the preceding full week, about 86,000,000 kw.-hr., was only a little more than half as great as it was in 1937, although somewhat larger than in 1936. Operations are well above last year's, everywhere except in the West Central area. New England, which crossed the line in late October, is up 12.4 per cent.

Per Cent Change from Previous Year

	Week Ending		
	Nov. 26	Nov. 19	Nov. 12
New England	+12.4	+10.2	+9.9*
Middle Atlantic	+ 5.8	+ 2.2	+2.4
Central Industrial	+ 4.6	− 0.1	+0.4
West Central	− 1.0	− 0.2	+1.6
Southern States	+ 6.6	+ 2.8	+1.4
Rocky Mountain	+ 4.6	− 2.2	−3.6
Pacific	+ 6.2	+ 4.9	+2.9
United States	+ 5.7	+ 2.1	+1.5

*Revised



The Middle Atlantic section has in five weeks changed from —0.2 to +5.8, the Central Industrial from —10.5 in October to +4.6. The Rocky Mountain, long running 20 to 25 per cent under 1937, is now 4.6 per cent above.

Weekly Output, Millions Kw.-Hr.

1938	1937	1936
Nov. 26..2,184	Nov. 27..2,065	Nov. 21..2,196
Nov. 19..2,270	Nov. 20..2,224	Nov. 14..2,170
Nov. 12..2,209	Nov. 13..2,177	Nov. 7..2,169
Nov. 5..2,207	Nov. 6..2,202	Oct. 31..2,176
Oct. 29..2,226	Oct. 30..2,255	Oct. 24..2,167
Oct. 22..2,214	Oct. 23..2,282	Oct. 17..2,170

Rules Ballot Plank Illegal in Kentucky

The Kentucky Court of Appeals has ruled unconstitutional that section of the 1936 state utility act which compelled authorization of a majority of a city's voters before the municipality could undertake to purchase, establish or operate a utility. In its opinion the court upheld the Daviess County Circuit Court's ruling that issuance of bonds by Owensboro for modernizing power plant and water system was valid, over objections of W. B. Booth.

Owensboro planned to issue $1,300,000 of bonds to rehabilitate the municipally owned electric plant and waterworks system, proceeds from the sale of which were to be supplemented by a PWA grant of $1,041,000.

•

Considers Municipal Plant

Village Councilmen at Eaton, Ohio, have under consideration a proposal for the erection of a municipal electric power plant. The matter was brought to the attention of the Council by Henry Pence, a Drake County REA director, who outlined that it was not necessary for the village to float a bond issue to finance the venture inasmuch as REA would furnish 45 per cent of the cost. Additional expense would be financed by mortgage bonds on the equipment.

•

Cozad Takes Over Facilities

Cozad, Neb., became the first city to acquire its electric distribution system under terms of the proposed statewide grid by which Nebraska hydroelectric districts and municipalities hope to take over the state's power industry. The city took over the Western Public Service Company's properties, having paid $60,000 for the facilities.

•

Chattanooga Lets Contract

Chattanooga Electric Power Board, Chattanooga, Tenn., has awarded a contract to the H. B. Nelson Company, Atlanta, Ga., on low bid of $244,288 for the construction of an overhead electrical distribution system in the city area between East Chattanooga and McCallie Avenue, including installation of about 4,000 poles, with lines and service facilities, and 945 street lights. Work is scheduled to begin at once.

Texas Power Consumption Declines During October

Consumption of electric power in Texas during October declined more than the usual seasonal amount from September, but was slightly above October last year, according to the Bureau of Business Research of the University of Texas.

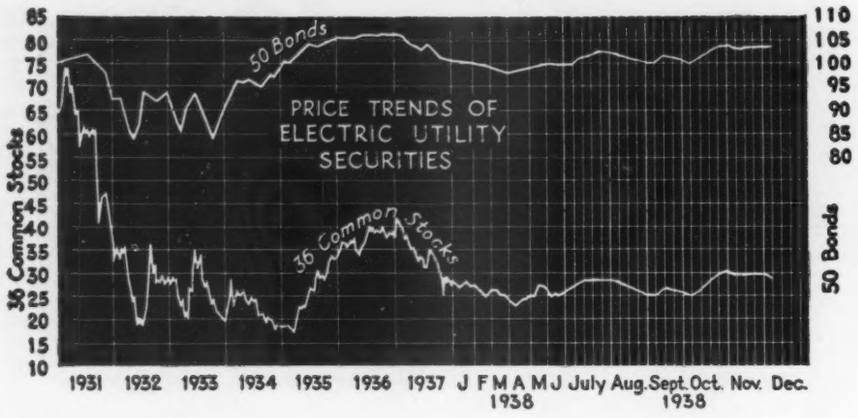
Reports from seventeen representative power companies show a decrease of 6.3 per cent in consumption from September and an increase of 1 per cent over October last year, the bureau said. Commercial consumption was down 10.2 per cent from September, but 14.7 per cent above October, 1937; industrial consumption decreased 2.8 per cent from September and was 8.7 per cent below October a year ago, while residential consumption declined 10 per cent from September, but was 11.9 per cent above October last year.

•

Will Drop Heating Service

Wisconsin Public Service Commission has granted the Wisconsin Gas & Electric Company authority to discontinue its heating utility in West Bend, on which the utility reported an annual loss of $8,000.

Stocks Continue Downward, Bonds Steady


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
50 Bonds
36 Common Stocks
36 Common Stocks
50 Bonds
1931 1932 1933 1934 1935 1936 1937 J F M A M J July Aug. Sept. Oct. Nov. Dec.
1938 1938

While some electric utility stocks showed gains on Tuesday last, for the week the "Electrical World" stock index was off 0.6 point to 28.6, lowest since the week of October 15. For the third consecutive week the bond index was steady at 103.4

Files $40,000,000 Bond Issue With SEC

Public Service Company of Colorado has filed with the SEC a registration statement covering $40,000,000 of first mortgage bonds, series due 1963; sinking fund debentures due 1948 to the amount of $10,000,000 and 50,000 shares of $100 par value cumulative first preferred stock, series of 1938. Proceeds will be used for refunding purposes and any balance is to be added to working capital.

Other statements filed recently with the commission follow:

The commission has handed down an order exempting from the provisions of Section 6(A) of the holding company act the issue and sale by Connecticut Light & Power Company of $15,000,000 principal amount of first and refunding mortgage 3¼ per cent bonds, series H, due 1968.

Application of Madison Gas & Electric Company, subsidiary of United Light & Power Company, for exemption from the same provisions of the holding company act of $1,000,000 principal amount of first mortgage 4 per cent bonds, series due 1960, was also granted.

Application of the New York State Electric & Gas Corporation for exemption from the requirement of filing a declaration in regard to the issue and sale of $155,000 of bonds as part of the purchase price of land and for an office building to be erected at Ithaca, N. Y., was granted.

Blackstone Valley Gas & Electric Company has filed a registration statement covering $4,000,000 of 3½ per cent mortgage and collateral trust bonds, series D, due 1968.

Acquisition by the Columbia Gas & Electric Corporation of 42,500 shares of common stock of its subsidiary, Dayton Power & Light Company, for $2,550,000 has been approved by the SEC. Proceeds will be used to retire $1,973,043 of 3 per cent demand notes of Dayton Power & Light held by the parent company, the balance to go into the treasury of the Dayton company, which expects to spend at least $600,000 out of its general funds this year for construction.

•

Virginia Company Omits Dividends on Preferred

Directors of the Virginia Public Service Company have voted to omit dividends on the company's 6 per cent and 7 per cent preferred stocks. The company explained that omission of preferred dividends at this time was necessitated by the fact that it had recently agreed with the Virginia Corporation Commission to expend about $3,600,000 for extensions and betterments to property and also to reduce its rates by $350,000.

Common stock of the company, all of which is owned by the Associated Gas & Electric Company, will receive no dividends for three years, according to the agreement with the commission.

•

Joint Hearing Deferred

FPC has announced that the joint hearing scheduled for December 1 with the Pennsylvania Public Utility Commission on certain operations of 35 companies and four officials of the Associated Gas & Electric System has been postponed to December 14. The postponement is due to unforeseen conditions and circumstances which make it impossible to proceed with the hearing on the date originally set.

•

Arranges for Large Issue

Philadelphia Electric Company is completing arrangements for the sale to life insurance companies of an issue of approximately $30,000,000 of first mortgage bonds. Proceeds of the sale, it is understood, will be used to pay off bank loans and for other corporate purposes.

•

Issues $24,500,000 Debenture Offering

Offering was made by prospectus only, and subject to prior sale through the exercise of subscription warrants issued to stockholders, of $24,500,000 of Commonwealth Edison Company convertible debentures, 3½ per cent series, dated July 1, 1938, and due on July 1, 1958. The subscription warrants will expire on December 21. The company announced that while the amount underwritten was $24,500,000, the minimum amount being offered to stockholders was $25,234,800.

Proceeds of the issue will be used principally for the redemption of all mortgage bonds of the Illinois Northern Utilities Company and the Chicago District Electric Generating Company.

The debentures are convertible at or before maturity into common shares of the company at $25 a share. This price is subject to adjustment in certain cases as provided in the indenture. In case of redemption prior to maturity the conversion privilege shall cease at the close of business on the fifth day prior to the redemption date. The conversion privilege is subject to termination in certain other limited cases.

•

Utility Gets Tax Refund

The Internal Revenue Bureau has announced that it had overassessed income taxes and interest totaling $154,034 against San Joaquin Light & Power Corporation, Fresno, Calif., for 1924–26. The bureau stated $31,454 was refunded and the remainder credited to the company.

Utility Reports (Earnings)

	Net Income 1938	1937
*The Commonwealth & Southern and subs.	$11,997,414	$15,935,468
*National Pwr. & Lt. and subs.	8,582,596	8,863,931
*Louisville G. & E. (Ky.) and subs.	2,637,635	2,853,851
*Wisconsin Pub. Serv. and sub.	1,323,550	1,456,574
†New England Pwr. Assn. and subs.	4,207,897	6,524,543
*Nebraska Pwr.	1,870,615	1,829,448
*Utah Pwr. & Lt.	1,341,626	1,716,841
*Dallas Pwr. & Lt.	1,606,360	1,567,890
*Houston Ltg. & Pwr.	2,946,262	2,713,628
*Texas Pwr. & Lt.	2,030,859	2,148,197
*Florida Pwr. & Lt.	2,472,511	1,697,467
*Louisiana Pwr. & Lt.	903,572	1,063,014

* Twelve months ended October 31.
† Twelve months ended September 30.

Field OPERATING PRACTICES

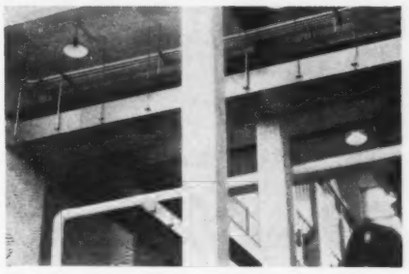
New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Metal-Clad Busway Saves Space and Labor

By A. F. HARTUNG
Burns & McDonnell Engineering Company, Kansas City, Mo.

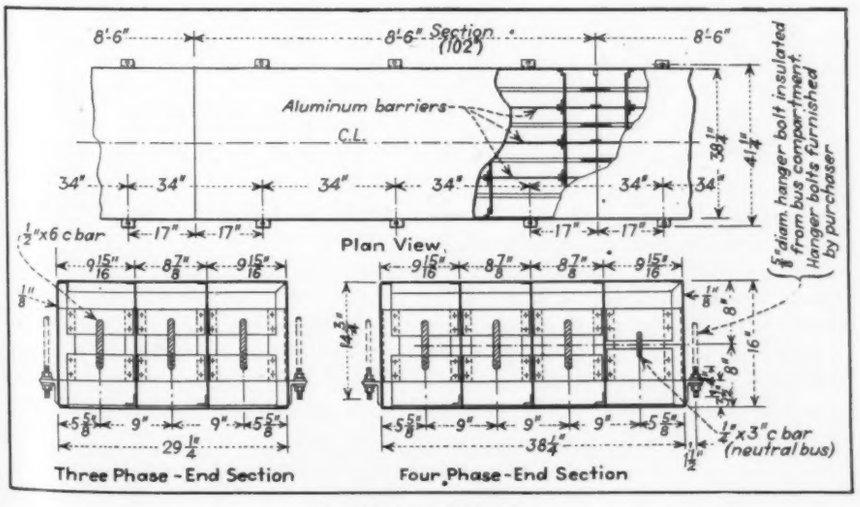
High current capacity in small space, high insulation value, neat appearance and minimum of erection labor required are features of the 2,000-amp., 15,000-volt metal-clad busway recently installed in the Quindaro station of the Board of Public Utilities at Kansas City, Kan. An addition to this station, including the installation of a 30,000-kw. turbo-generator and the building of a new switch house, has lately been completed and it was in this new work that the busway was used.

The busway consists of Micarta insulated copper bars supported in an inclosing steel housing and with aluminum barriers between phases. Complete phase isolation is thus provided. The busway was shipped in sections of 5 ft. and longer and these were raised in place and connections made between sections. Each joint is insulated with a Micarta sleeve and then filled with hard insulating compound. A single 6-in. x ½-in. copper bar is used for phase conductors and a 3-in. x ¼-in. bar for the generator neutral conductor. The over-all width of the three-conductor busway between bus sections is only 29¼ in. and the width of the four-conductor busway from the generator is 38¼ in. The depth of the busway is 16 in.



Busway installed

The generator busway extends right up to the generator terminals and the inclosing housing is bolted to the generator frame. Six-conductor busway is used from the generator terminals to the generator neutral current transformers which were installed in the busway and four-conductor busway extends from this point to the buses. Altogether approximately 140 ft. of 15-kv. busway was used, including ten right angle bends.

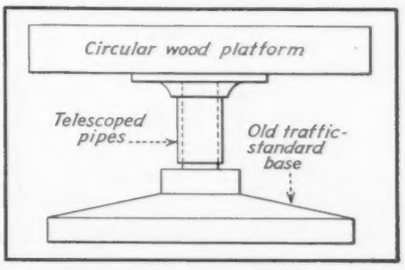


Prefabricated busway

The plan view at the top shows the Micarta conductor supports, aluminum barriers between phases and the steel inclosure. The end section shows the attachment of hanger bolts.

Rotating Stand Saves Work in Meter Shop

For painting and other work on current transformers and such heavy, chunky apparatus, a handy thing in the meter repair shop is a small rotating platform, similar to a small piano stool, but without the vertical screw. Such a device is used in the meter department of the Indiana General Service Company at Marion, Ind. The very simple construction of the platform is apparent from the accompanying sketch. The foundation is an old traffic standard with the



Used mostly for painting current transformers

pipe cut off about 4 in. above the base. On this, by means of a piece of slightly larger pipe held in a blank flange, is set the revolving platform, a circular block of wood about 18 in. in diameter cut from a 2-in. plank.

•

Floodlighting Tower Uses Ring Bus

By JAMES W. SANDERS
Superintendent of Distribution,
Nassau County Division,
Long Island Lighting Company

For illuminating the municipal parking field, 400 ft. square, of the village of Hempstead the Long

Serve tower-mounted floodlights from ring bus

Island Lighting Company erected a steel tower at the center of the field, surmounted by a platform carried on a simple cantilever structure of four steel angles 50 ft. above the ground. A guard rail, supported by eight posts, serves also for mounting eight 1,000-watt floodlights.

Current for the floodlights is supplied through a ring bus, carried on spools just below the platform guard rail. If necessary for cleaning or replacement, each floodlight can be swung over for easier accessibility from within the railing. At present 500-watt lamps are used, fitted with adapters to center the light source at the proper point. The illumination can be doubled by replacing them with 1,000-watt units. To allow for the greater distance, lamps pointing toward the corners of the field are adjusted for a more concentrated beam than the other four lamps, which are directed toward the sides.

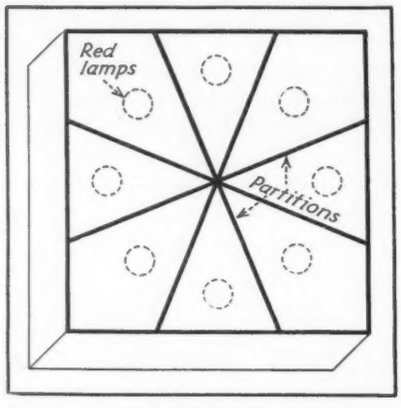
Current is cut off at 1 a.m. by a time switch. During the remainder of the night the field is lighted by a lamp at each corner, fed from the street lighting circuit, so that it is never in total darkness.

•

Wind Indicator Obviates Guesswork

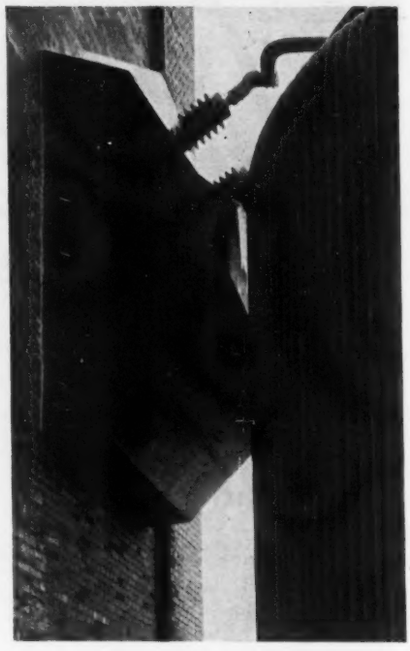
Wind direction is a usual item of entry on substation operating logs. Sometimes the determination is simply left to the judgment of the operator, who guesses by the inclination of treetops or the position of a wind sock, flag or vane. Something better than just a guess at wind direction is desirable if it does not cost too much.

A "something better" at very little cost was assembled by one of the operators with material on hand at the Delaware substation of the Indiana General Service Company a few miles north of Muncie, Ind. A homemade wind vane carrying eight contacts was mounted on the roof of the building and wires run down to the switchboard room. Here, mounted on the wall, is a frosted glass front, flat wood box partitioned into eight segments, each containing a red lamp connected to corresponding contacts on the vane. The appearance of this indicator is as shown in the accompanying sketch. The segments of the indicator bear no compass designations because they are few, and north is, as customary, at the top. The three other cardinal directions and the four intervals are thus readily identified.



Simple wind indicator for substation

SAVES WALL BUSHINGS

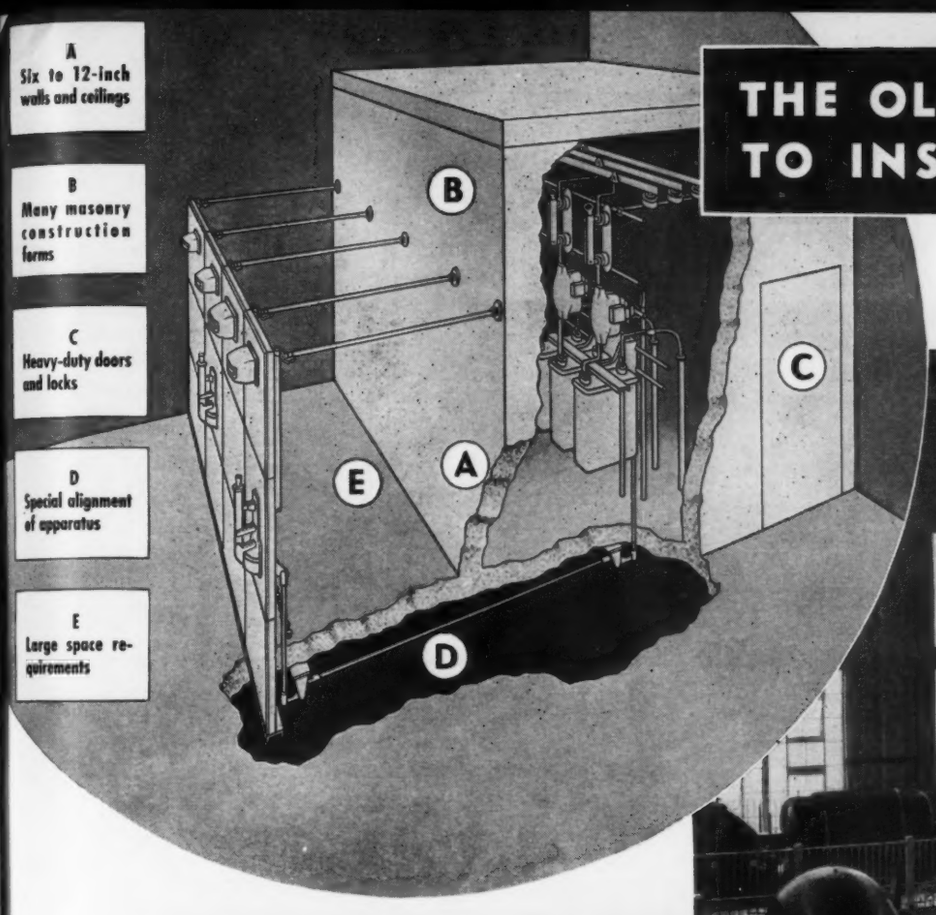


Standard bulk substation construction of the Detroit Edison Company includes the inclosure of high-voltage buses in sheet metal housings. Where connection is made to a bank of transformers outdoors the housing might have been terminated inside and the leads bushed through the wall in classic fashion. But it was simpler—and less costly—to carry the housing itself through the wall, thus eliminating the wall bushings entirely.

Small Lamp Speeds Meter Repairing

Surgeons have their "grain of wheat" electric lamps that can be inserted into the human economy to facilitate examination. Although the meter and instrument repair man in the electrical laboratory has no use for such a very small lamp, yet he will find that a miniature lamp of the flashlight type can be poked into the interior of an instrument that is being cleaned or repaired and will show up dirt and other conditions difficult to see by light directed in from outside.

A light of this kind finds almost constant use on the repair bench in the meter department of the Milwaukee Electric Railway & Light Company. It consists of a three-cell flashlight with no lamp in the end, but with flexible leads brought out to the lamp, which may be poked into the instrument being cleaned or repaired as the repairman desires.



THE OLD, HARD WAY TO INSTALL SWITCHGEAR

NEW, EASY, SAFE WAY

For Your Pocketbook's Sake, Too . . . Put In Metal-enclosed Switchgear

Any way you look at it, buying metal-enclosed switchgear means economy.

Consider:

(1) The benefits in safety and in operating advantage

(2) The completely factory-assembled job that you receive

(3) The savings in over-all installation time and cost

Specify metal-enclosed switchgear for *all* your switching requirements. General Electric, Schenectady, N. Y.

RECOGNITION BY THE N. E. C.

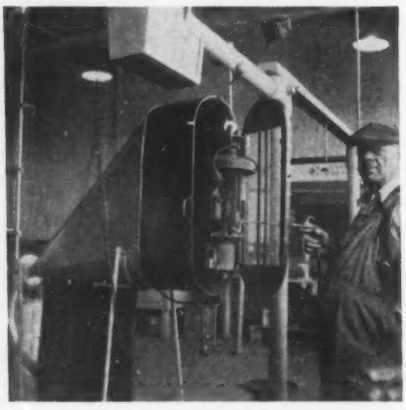
It is significant that, on circuits of 5000 to 15,000 volts, the present National Electrical Code puts metal-enclosed gear in the preferred class. It prescribes that these oil circuit breakers shall have a metal enclosure—or be remotely controlled in a specially constructed fire-resistive vault.

GENERAL ELECTRIC

880-33

Arc Lamp Cleaning Made a Clean Job

Cleaning arc lamps (quite a number remain in service in many cities) is a dusty job in the maintenance shop. The Toledo Edison Company has solved the problem with a dust "hood" or inclosure shown in the illustration. The lamp to be cleaned, hung on a rod from above, is inclosed in the dust hood, which is equipped with a suction blower discharging into a dust bag hung below. A vertical slit in the glass door of



Special inclosure makes for dustless cleaning of arc lamps

the inclosure permits the operator to insert the nozzle of an air hose and play compressed air on the internals of the lamp. Thus the dust is removed quickly and cleanly and is packed into the bag by the blower.

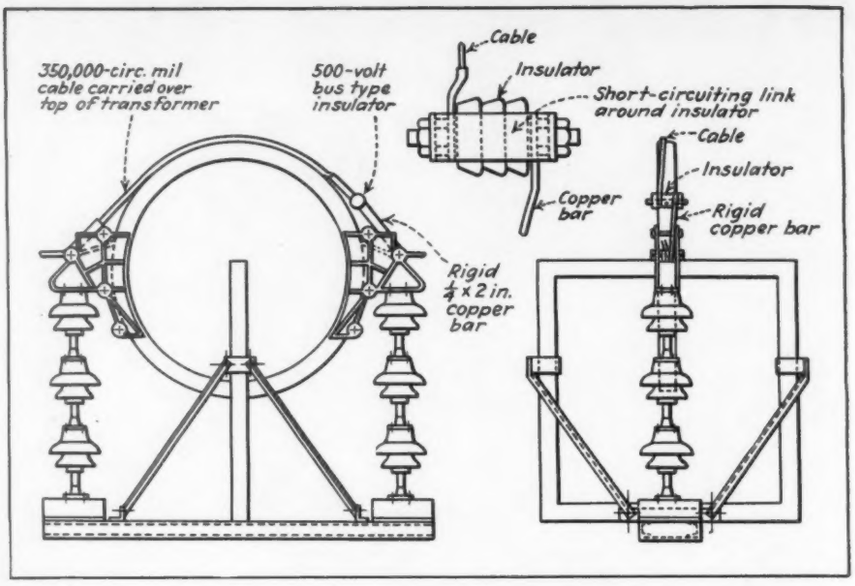
•

Protects Equipment While Melting Sleet

By L. W. STOCKNER
Superpower Company of Illinois, Kewanee

Removal of sleet from high-voltage transmission lines by building up the short-circuited current in a system to such proportions that the accumulated ice is soon reduced to water, which rapidly runs off, has become an established procedure with many utilities.

Since removal of the ice depends on the I^2R heat loss, it is difficult to predict just exactly what value of current will have to be reached and how long it will be maintained. These unpredictable conditions call for a positive method of protecting current transformers and other supplementary equipment which may be in the circuit involved. We have come to the conclusion that the affected equipment must be short circuited during melting with a low-resistance shunt to give positive protection.



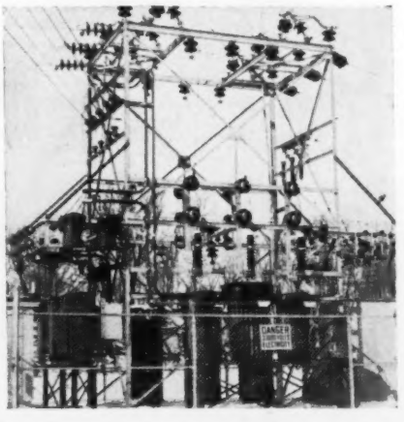
Removable link protects current transformer during sleet melting

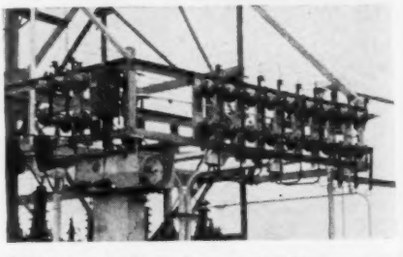
The accompanying diagram shows the Niagara type of transformer used. We first made up temporary short-circuiting shunts for taking care of the secondaries of these transformers. This protected the meters and relays, but as the values of current increased we found that we were overloading the primaries of the transformers.

For the protection of the transformer primaries permanent shunts have been installed which require only the placing of a copper bar link to put them in service. A flat strip of copper bar, ¼ x 2 in., about 18 in. long, has been solidly fastened to one terminal of the current transformer by bolting it to the through-bolt which holds the current transformer and the line conductor lugs. On the opposite end of this strip was securely bolted a 500-volt bus insulator. A 350,000-circ.mil copper cable from the opposite terminal of the transformer is tied securely to the primary ring and fastened to the other terminal of the insulator. During normal operation this installation does not interfere with the operation of the transformer and the voltage across the insulator is of a low value.

For melting conditions a link of copper has been made up to fit across the terminals of the insulator where it can be bolted into place, thus closing the circuit and shunting out the primary. The time required to drop the link in place and bolt it is about five minutes per circuit. The set-up does not interfere with normal operation of the circuit when not in use, but is still readily accessible when needed.

RURAL SERVICE ADDS TO SUBSTATION DUTY





Addition of farm lines to utility systems in recent years has changed the appearance and enlarged the duty of many small substations. The general view shows how a substation structure on the Iowa Electric Company system has been extended economically to provide mounting facilities for added equipment. The detail picture indicates the manner of assembly.

Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Drum Scheme in Oven Speeds Up Production

Four small 1½-kw. electric ovens originally preheated duralumin horse-shoes, or racing plates, at the Baltimore, Md., plant of the Victory Racing Plate Company prior to forging. But they couldn't keep up with production requirements. Now the preheating is done in a single, 9-kw. specially designed oven capable of turning out 160 shoes an hour at exactly the proper forging temperature.

Unusual oven design

Duraluminum, of which the shoes are made, must be forged between definite limits of temperature and forging must be done promptly or reheating is necessary. Thus, besides careful temperature control an oven design was necessary that would make hot shoes quickly and continuously available at the forger's tong ends. A double-decked drum, with 40 compartments in each deck for individual shoes, is arranged in the oven chamber. This drum or rack is rotated clockwise one section at a time by a ratchet mechanism operated by the treadle door opener. Eighty shoes are placed in the oven through a door in the rear before heating up.

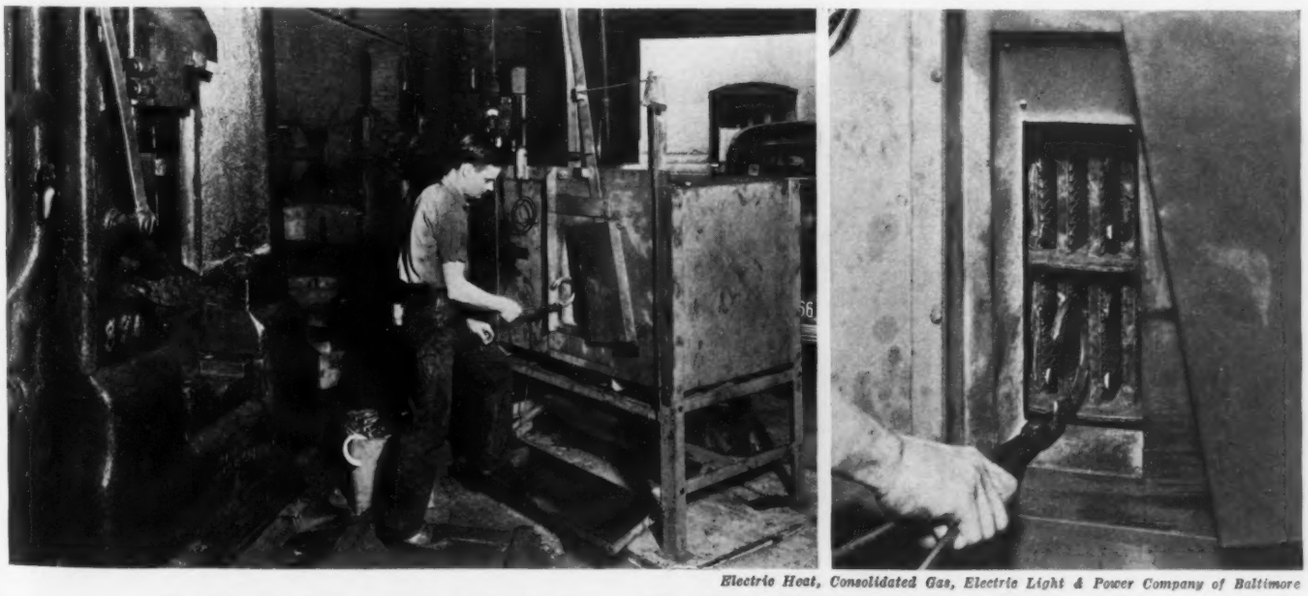
After the oven reaches a temperature of about 650 deg. F. (it takes about 45 minutes) forging begins. Depressing the treadle opens the small door and allows a shoe to be removed. After it is forged the door is again opened, a cold shoe inserted in place of the hot one just withdrawn, and a second hot shoe removed. In this way the stock of shoes is constantly replenished. Since the ratchet advances the drum a section at a time hot shoes are always at hand. Cold shoes travel the complete circuit before coming up for use. With 160 shoes being turned out per hour each shoe is in the oven 30 minutes.

Limit switch and thermostat

A limit switch is provided in addition to the adjustable thermostat. This limit switch rings a bell and opens the heating circuit when temperature exceeds by 10 deg. the setting of the thermostat. Electric heating elements are located above the drum.

Air is forced through the grillwork beside the drum to increase the rate of heating and insure temperature uniformity.

This special furnace was made by Lydon Brothers, Jersey City, N. J., to a design worked out jointly with the customer by the electric heating



Electric Heat, Consolidated Gas, Electric Light & Power Company of Baltimore

Special oven design speeds production by providing for continuous preheating of racing plates

Left—General view of oven. Right—Close-up of operating door showing rotating rack.

bureau of the Consolidated Gas, Electric Light & Power Company of Baltimore.

•

Cupola Iron Duplexed in Rocking Furnace

By W. A. FERRIS
Industrial Heating Engineer
Southern California Edison Company, Ltd.

Rapid advances in metallurgy have in recent years burdened the iron foundry with a problem that reduces, in brief, to competition from steel. One California iron foundry, the Ace Foundry at Huntington Park, has met the problem of making better iron at lower cost with the installation of a rocking-type electric furnace for "duplexing" cupola iron. Duplexing is a method of controlling the composition of iron beyond the limits imposed by the cupola. Molten iron from the cupola is introduced into the electric furnace, where it is further heated and its composition corrected by the addition of steel, carbon or silicon to produce an iron of ideal properties for the type of casting desired. Furnace used at the Ace Foundry has a capacity of 6,000 lb. of molten iron and is supplied from a 300-kva. transformer with energy at 100 volts.

Duplexing cupola iron in a rocking type electric furnace has several advantages. Among these are: (a) Rocking action of the furnace thoroughly mixes the charge to produce a homogeneous casting of uniform structure; (b) composition and properties of the casting may be controlled with arithmetical precision; (c) properties of the casting—*i.e.*, tensile strength, deflection, transverse strength, and ease of machining—may be improved to a point far beyond cupola iron; (d) metal is saved because the first cupola heat, usually pigged because it is too cold to pour, is heated to the proper temperature in the electric furnace, and (e) cost of producing this superior iron is from 5 to 10 per cent less than producing the best straight cupola iron This is due to the fact that nothing but scrap need be used in the cupola because the correct carbon-silicon balance for the iron is produced in the electric furnace.

Cupola iron "duplexed" in rocking furnace costs 5 to 10 per cent less and has better properties than best cupola iron

W. De Santis, owner of the Ace Foundry, has this to say about duplexing in the electric furnace: "We are more than satisfied with our electric furnace. It not only produces a better iron at a lower cost but it enables us to make iron of several different compositions from the same base heat. This flexibility of operation speeds up deliveries on small diversified orders without increasing our costs."

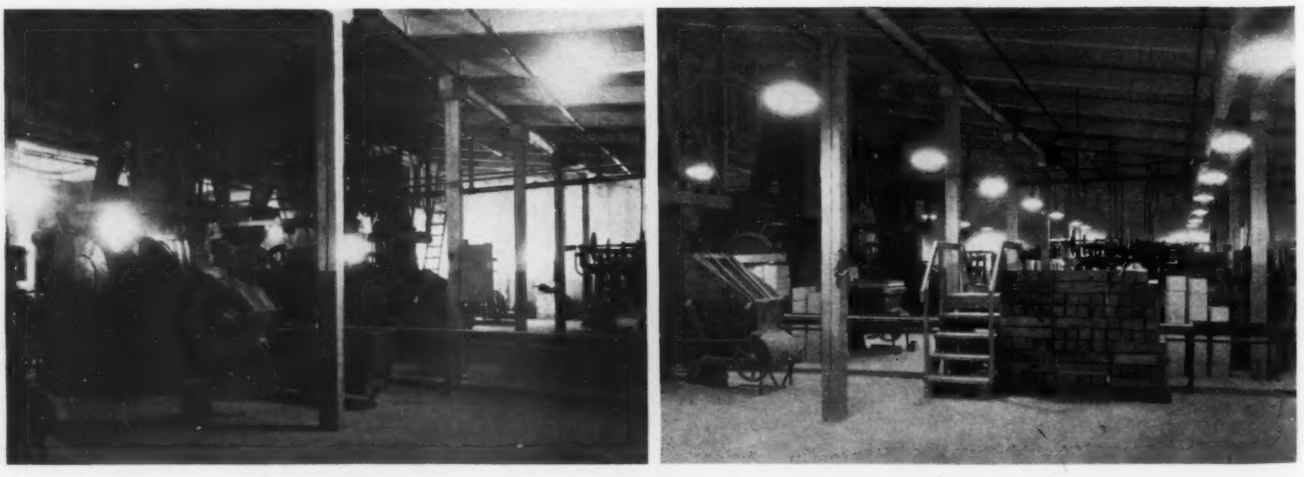
•

Improved Lighting Improves Production

By R. E. SERGEANT
Jersey Central Power & Light Company,
Red Bank, N. J.

Glare and shadows from pendant, unshaded lamps made seeing, especially in the presence of moving machinery, a difficult task at the Mosaic Tile Company, Matawan, N. J. But it was not until the plant lighting was redesigned that the effect of these conditions upon production was fully appreciated. Now the management declares that the ". . . cost of installation and maintenance of this (lighting) equipment is very small compared to the increase in quantity and quality of production."

To obtain the 24 ft.-candles of illumination now existing, 11.1 kw. of incandescent lighting was installed, resulting in a density of 2.5 watts per square foot. A total of 37 RLM domes, for use with 300-watt PS-35 incandescent lamps, equipped with dust-tight covers and spaced 10x12 ft., 10 ft. 6 in. above the floor, were used. Ceiling height was 14 ft. 6 in.



Advantages of shadow-free, glareless lighting in tile manufacturing plant overbalance cost of installation and maintenance

"It's a BIG JOB to sell ADEQUATE WIRING *in* Old Homes *—but the* FUSTAT can help you do it"

Stops overloading that hinders the full use of electricity

The branch circuit is the "bottle-neck" of electric service, because through it flows all the "pay load" to the user. As this "bottle-neck" is overloaded, SATISFACTORY service diminishes because:

1. Overloading usually means a low-voltage condition that causes user dissatisfaction due to inefficient operation of lamps and appliances.

2. Overloading, when continued often destroys the wiring and causes money loss to the user — revenue loss to the Utility and tremendous loss of good will to the entire industry.

The Fustat steps in to help correct this overloading evil

Its non-tamperable feature shuts out "handy men" from substituting too large a size, and tampering it in any way to permit overloading is virtually out of the question — without such tampering being clearly visible where it warns the user that all protection is gone.

Since the user can't load a circuit beyond proper capacity of the copper, the Fustat eliminates revenue sapping low-voltage conditions —

And by blocking excessive overloading it prevents overheating that destroys wiring, creates fire hazards and causes costly shutdowns.

In addition, when a Fustat does blow to protect, only the *normal load* on one circuit is off the line — instead of a user possibly having a large part of his lights and appliances out of service.

User can't side-step adequate wiring issue

When additional circuits are needed the user cannot readily side-step the issue at the sacrifice of safety. New circuits that increase efficiency of appliances and encourage their greater use must be installed.

Permits more outlets per circuit

Adding a maximum number of outlets is a perfectly safe practice because the Fustat guards the circuit against overloading.

Wipes out any excuse for tampering

A Fustat won't blow when washing machines, refrigerators or other motors start because of its long time-lag. It wipes out any excuse for tampering or the use of fuses too large to properly protect when shorts occur in flexible cords.

Helps get more appliances on the line

The circuit can be loaded to approved capacity without needless blows — or sacrifice of safety — for the Fustat doesn't blow on starting currents.

What is the Fustat?

Adapter retails at 7½c

It is a fuse to which a thermal cutout is added.

It protects like a fuse against short circuits—even high resistance shorts such as occur in flexible cords.

It protects against permanent overloads, even when as light as 25%.

Yet it will not blow on motor starting currents of washing machines or other appliances.

It has a non-tamperable base that keeps anyone from robbing the circuit of protection.

It fits Edison base fuseholders through the use of an inexpensive adapter.

It's just good business to sell, install and use Fustats

The FUSTAT

For full information write to any of these firms

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo.
JEFFERSON ELEC. CO., Bellwood, Ill.
KIRKMAN ENGINEERING CORP., 121 Sixth Ave., New York City
NATIONAL ELECTRIC PRODUCTS CORP., Fulton Bldg., Pittsburgh, Pa.
UNION INSULATING CO., 27 Park Place, New York City

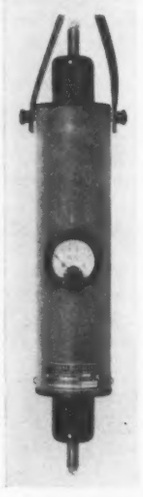
New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Design Voltmeter For Phasing Out

By T. A. RICH
General Engineering Laboratory,
General Electric Company,
Schenectady, N. Y.

A portable high-resistance voltmeter designed particularly for "phasing-out" distribution circuits has been developed by the General Electric Company for use on 5,000-volt lines. Basically the unit consists of a rectifier-type milliammeter connected in series with a small neon lamp and two high-voltage resistors.* Component parts of the unit are housed in a transparent plastic tube, the outside of which is frosted except for a small window through which the instrument is read.



Phasing-out voltmeter incorporates new high-voltage resistors

Shunted around the rectifier type instrument is a suitable resistor, so that in the possibility of an open circuit developing in the instrument the neon lamp will continue to glow if voltage is present. Because of this arrangement the entire voltage is applied to the neon lamp until it starts to glow. Since the lamp glows above 100 volts the operation of the lamp and instrument can be checked at low voltages. At higher voltages the illumination of the lamp not only facilitates scale reading in darkness but the intensity of illumination is a rough measure of the voltage. Nominal accuracy of the voltmeter is 10 per cent, although successive readings will duplicate to much higher accuracy. In locating sources of trouble this precision is often of great value as variations in light intensity of neon lamps are not sufficient to indicate small changes in voltage.

Total resistance of the voltmeter is so high that exceptionally good insulation is required if surface leakage at high humidities is not to introduce errors. All components are said to be capable of withstanding a steady voltage of 10,000. Assembled units are given a high potential test of 15,000 volts between the electric circuit and external exposed parts.

Dimensions of the instrument are $3\frac{1}{2}$ in. in diameter, 20 in. long. Weight is about $4\frac{1}{4}$ lb.

* High-voltage resistors of the type used were described in ELECTRICAL WORLD, April 9, 1938, page 78.

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Device Locates Pipe Within Two Inches

Accurate line locations within two inches and depth determination within 10 per cent are the claims made for a pipe line detector that has been specially designed to follow a single designated pipe line across country without interference from other lines, close to or crossing the line followed.

Complete, the apparatus consists of a receiver, transmitter and dry batteries, headphones, two ground spears, leads, etc. In operation one terminal of the transmitter is connected to the line to be followed, either through surface equipment

Line locater spots line within two inches and determines depth within 10 per cent

connected to it or through a ground spear driven down to contact the pipe. The other terminal of the transmitter is connected to the second ground spear driven in the ground at right angles to the line and about 100 ft. from it. When the transmitter is turned on oscillations are set up in the pipe which are detectable with the receiver and headphones.

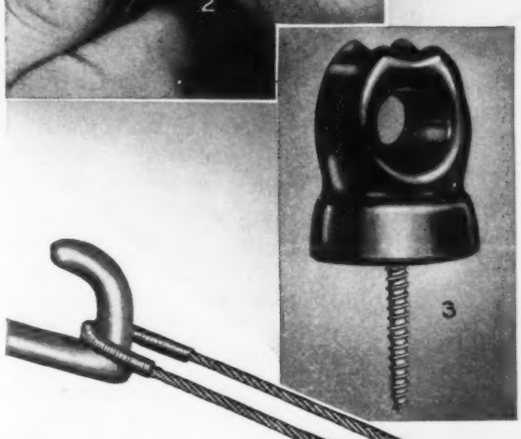
The operator, in following the line, carries the receiver in one hand as shown in the illustration, with the receiver in a vertical position parallel to the line. In this position the intensity of the signal in the headphones, picked up by the receiver from the line, indicates when the operator is over the line.

When it is desired to spot the location of the line exactly the receiver is held horizontal, close to the ground. By moving the receiver slowly across the location of the line

SAVE INSTALLATION TIME—IMPROVE APPEARANCE AND SAFETY

with KEARNEY ACCESSORIES specially designed for the job

ELIMINATE sharp corners of guy guards that might induce claims for injury... get 100 per cent visibility... Kearney Full-Vu Guy Guards are full round—no sharp corners or exposed bolts.... Remove hazards of frayed wire ends—use strand bands or guy wire clips for neatness, plus safety.... Install house knobs that fit flush, even though screws are put in on an angle. Floating screws in Kearney Fit-Rite Wire Holders afford this advantage, at no extra cost.... Support oval or round cable with the revolutionary Lay-Cit Service Cable Grip—it doesn't injure braid sheath or conductor insulation; holds under ice load and wind pressure on spans up to 125 feet.... These are just a few minor Kearney Pole Line Accessories, carefully designed to increase efficiency—improve appearance—help you do better jobs more quickly and profitably.



other ACCESSORIES *AVAILABLE*

Many other items are shown and described in Bulletin 300. Order these products with assurance of satisfaction guaranteed. Write for latest prices and quantity discount.

1 *Full-Vu Guy Guards will not chafe guy wire. Available in 7 or 8 feet lengths.*

2 *Kearney Strand Bands and Guy Wire Clips are inexpensive—made in variety of sizes for your requirements.*

3 *Fir-Rite Wire Holders are made in three styles—insert (shown) also band and spool types.*

4 *Kearney Lay-Cit Cable Grips come in two types to handle range of sizes.*

SEE MANY TIME AND MONEY-SAVING ITEMS IN THIS BOOK

JAMES R. KEARNEY CORPORATION

DESIGNERS AND MANUFACTURERS OF OVERHEAD AND UNDERGROUND

UTILITY EQUIPMENT

4224-42 CLAYTON AVENUE SAINT LOUIS, MO.

IF YOU DO NOT HAVE A BULLETIN NO. 300 WRITE

a point is found where the signal cuts out. This point will be directly over the line and permits location of the line with extreme accuracy, it is said.

To determine the approximate depth of the line it is first spotted as described and this spot marked on the ground. Then with the receiver held at 45 deg. to the horizontal it is moved away from the line until the signal cuts out. A second point is then marked on the ground perpendicular to the center line of the receiver. Depth of the line is equal, within 10 per cent, to the distance between the two marks.

This detector is manufactured by Engineering Laboratories, Inc., affiliate of Seizmograph Service Corporation, Tulsa, Okla.

•

Plating Process Uses Low Current Density

An electroplating process for covering wires and shapes with zinc, tin, copper, brass and other metals and in which cleaning and pickling, as well as plating, are done electrically is being introduced here after five years use in England.

Known as the Marino process, this method of plating uses commercial zinc and somewhat lower current densities than are common here. Applied to galvanizing, this process is said to be 50 per cent faster than hot galvanizing and 40 per cent cheaper. With it 4,500 to 5,000 kw.-hr. is required to deposit a ton of zinc. This figure remains static regardless of the gauge of the wire. Speed with which wires of different sizes may be run through the process, together with other data based on experience with the process in England, is given in the accompanying table.

Experience with Low-Density Plating Process

Wire Gage British Std.	Decimal Equiv. (In.)	Speed of Process (Ft. per Min.)	Tons Wire per Ton Zinc	Kw. Hr. per Ton Wire
1	0.300	6	62.5	72- 80
2	0.276	7-8	55.5	81- 90
3	0.252	7-9	50	90-100
4	0.232	10	45.5	100-110
5	0.212		41.5	108-120
6	0.192	10-12	37.7	119-132
7	0.176		34.5	130-145
8	0.160		31.7	142-157
9	0.148		29.4	153-170
10	0.134		27.4	170-182
11	0.120		25.3	178-197
12	0.109		23.6	190-212
13	0.092		22	204-227
14	0.080		20.6	218-242
15	0.072	95	19.4	232-258
16	0.064	100	18.1	248-276

Size of Plant	Range Gage	Capacity, Wires	Production tons per 48-Hour Week
Heavy wire	¼-in. rods to 12	12 wires	16 to 20
Intermediate	12 to 17	28 wires	11 to 18
Fine wire	17 to 32	50 wires	3 to 4

Throughout the process the anodes, which are the ingots of the metal to be plated, are held in a fixed position and the wire raised and lowered in the processing baths to provide the adjustment required. Adjusting is done with a counterbalanced sheave arrangement, the guide rolls of which serve as one pole of the plating circuit with the fixed ingot as the other.

The accompanying illustration shows a galvanizing unit of this process in operation in an English plant. George D. Hartley, Worcester, Mass., consultant, is agent for the process.

Low current density electroplating process uses 4,500 to 5,000 kw.-hr. per ton of commercial zinc plated

•

Stainless Steel Has Merit as Conductor

Introduction of stainless steel as a conductor material for high-tension ignition cables for automobiles and airplanes by the National Bureau of Standards reportedly contributes advantages of higher top speed, lower idling speed, longer spark plug life and less interference with short-wave radio. Although present applications of this material to cables are limited to internal combustion engines, it appears that applications in the electrical industry may develop.

Considerations listed by Dr. Melville Peters, senior physicist of the bureau, as seeming to make stainless steel desirable as an ignition cable conductor follow:

The energy which must be furnished by the spark coil to cause the spark plug to fire is proportional to the capacitance of the secondary circuit. In many ignition systems the greatest portion of the capacitance is due to the high-tension ignition cable. By decreasing the capacitance of the ignition cable with respect to the engine less energy is required from the spark coil and consequently less energy from the battery. The capacitance of the cable is decreased by decreasing the size of the conductor.

Measurements have shown current discharges of 30 to 80 amp. across the spark plug electrodes. These discharges last about one-millionth part of a second and consist of ten to fourteen oscillations. After the initial discharge it is desirable to damp out all other oscillations as quickly as possible so as to reduce electrode wear. This is done by using a high-resistance conductor.

Decrease in heat transfer from the spark plug to the rubber insulation may be accomplished by using a conductor in the cable which is a poor conductor of heat.

Furthermore, with the decreased cross-sectional area the conductor must be sufficiently strong to permit drawing the cable through conduit. A material that has been found to satisfy these requirements is stainless steel.

WELD STAINLESS STEEL OR NON-FERROUS METALS WITH SQUARE D PRECISION CONTROL

This assembly includes welds of copper to copper, copper to bi-metal, and copper to silver alloy.

Precision welding timer

● The successful welding of small metal parts—particularly stainless steel and aluminum—depends upon the very accurate control of the welding cycle. Variations in time or current wave form cause an excessive percentage of spoiled parts or imperfect welds. Heretofore, only expensive and rather intricate welding equipment has given satisfactory production.

With the new Square D precision welder control, a standard resistance welding machine can be adapted to the economical fabrication of small metal parts—copper, brass, aluminum, stainless steel and other metals. The investment is comparatively small.

Square D precision control consists of a synchronous motor-driven timer and a magnetic contactor, having two poles individually actuated and operating in sequence. The circuit-opening pole is self-synchronized to open at minimum arcing point. Welding periods in half-cycle steps are obtained accurately. The timing range is from one-half to ten cycles. A neon tube behind a revolving slotted disk gives the operator a visual check on the accuracy of the welding cycle.

Inexpensive, easily installed and easily operated, this control permits welds heretofore impractical. Write for Precision Welding Bulletin.

Synchronized welding contactor

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CALL IN A SQUARE D MAN

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Idaho Power Aids Kitchen Builders

By J. CARL BALDRIDGE
Idaho Power Company, Boise

Personalizing its assistance to home builders in the planning of their kitchens has been the endeavor of Idaho Power Company in pursuing a plan which was adopted several months ago and since then has been undergoing the ordeal of perfection through practice.

Adapted from, and not unlike, the program of the Modern Kitchen Bureau, Idaho Power's endeavor starts at the initial contact of the company's salesman with the prospective home builder. The salesman first ascertains such specifications of the proposed kitchen as will affect its electrification and notes this information on a sheet similar to the form sheet of the bureau.

This information is then combined with electrical specifications common to all kitchens to produce a loose-leaf folder, bearing the prospect's name and proposals designed to assure him a modern, efficient electric kitchen.

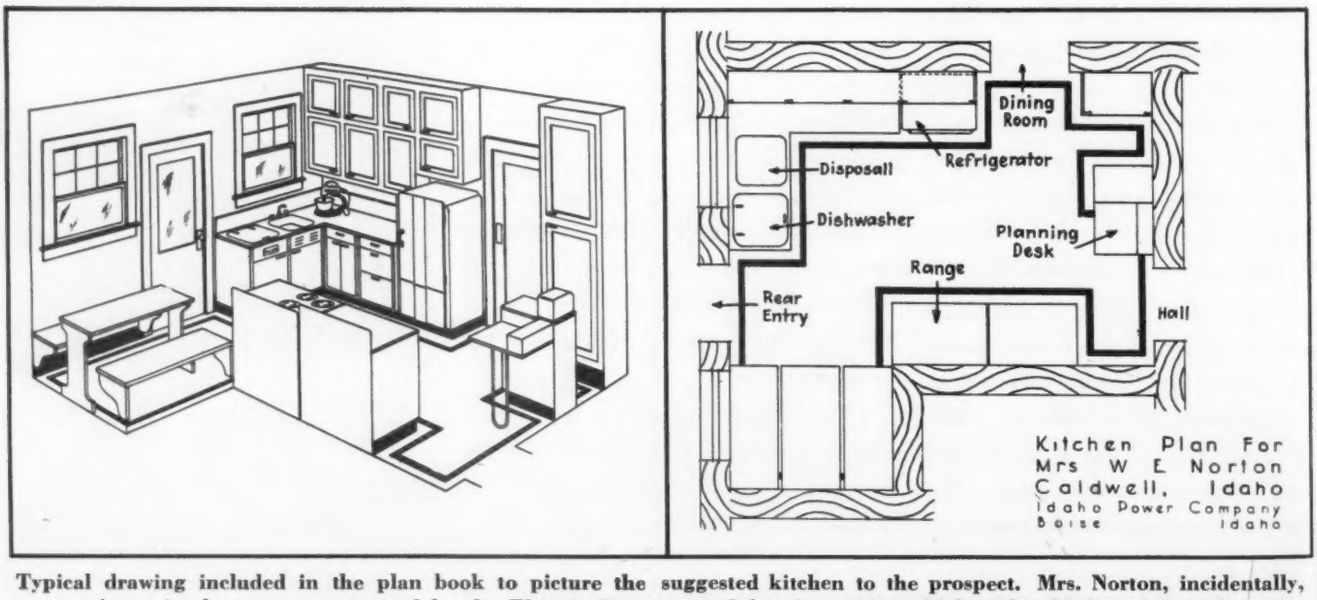
The cover carries the prospect's name. The fly-leaf says: "Here is the design for your planned, step-saving kitchen. Please accept it with our compliments." The whole is designed to give him a picture of what his kitchen is going to be like and to assure him that a personal endeavor has been made to have it coincide with his desires.

It opens with two pages (mimeographed) devoted to "electric maids," referring very briefly to the general advantages of electrical appliances and outlining the principles behind modern kitchens, such as working centers, storage space, effect of light and colors, etc.

Next comes a simple drawing showing the arrangement of equipment, as it will appear in the suggested design. The drawing includes a floor plan and a perspective view. The latter is drawn with a viewpoint taken above and well outside the kitchen (wall on the near side being omitted), a treatment which has been found to give a more vivid picture to the average customer than a close-up, eye-level view because of the reduced distortion. These are drawn with pencil, photostated and the copy tinted in color.

Next comes a sheet on standard dimensions for kitchen equipment, followed by two more mimeographed pages containing a more explicit statement of the advantages of specific major appliances. The last two pages contain drawings of kitchen-illuminating equipment available through dealers in the territory.

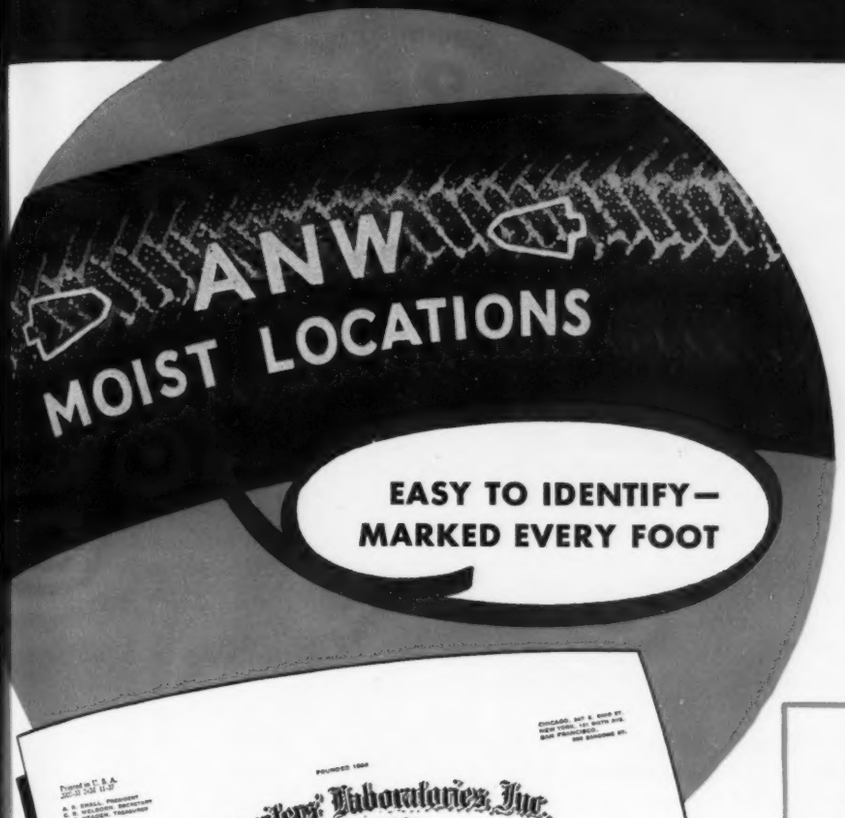
Ray Severine, kitchen expert, and

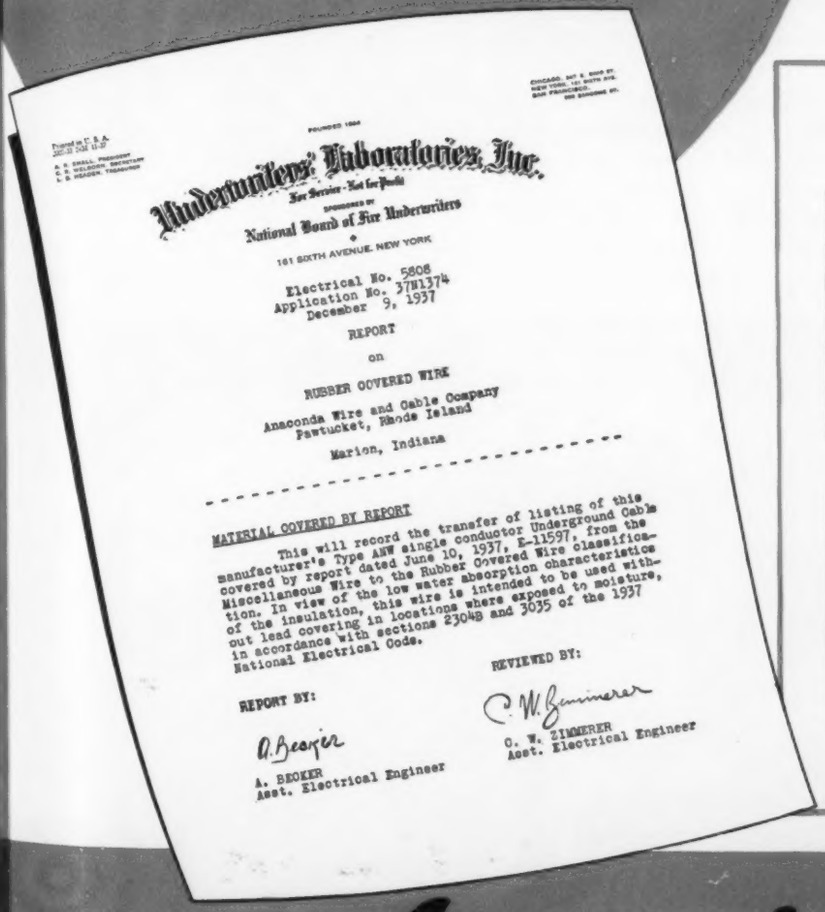


Typical drawing included in the plan book to picture the suggested kitchen to the prospect. Mrs. Norton, incidentally, was a winner in the contest sponsored by the Electric Equipment Sales Association, Idaho, this kitchen being the prize

APPROVED

for moist locations without lead sheath





Underwriters' Laboratories, Inc.
For Service - Not for Profit
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National Board of Fire Underwriters
161 SIXTH AVENUE, NEW YORK

Electrical No. 5808
Application No. 37NK1374
December 9, 1937

REPORT
on
RUBBER COVERED WIRE
Anaconda Wire and Cable Company
Pawtucket, Rhode Island
Marion, Indiana

MATERIAL COVERED BY REPORT

This will record the transfer of listing of this manufacturer's Type ANW single conductor Underground Cable covered by report dated June 10, 1937, E-11597, from the Miscellaneous Wire to the Rubber Covered Wire classification. In view of the low water absorption characteristics of the insulation, this wire is intended to be used without lead covering in locations where exposed to moisture, in accordance with sections 2304g and 3035 of the 1937 National Electrical Code.

REPORT BY:
A. BECKER
Asst. Electrical Engineer

REVIEWED BY:
C. W. ZIMMERER
Asst. Electrical Engineer

...and marked for easy identification

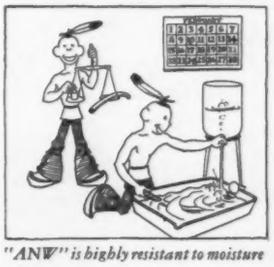
ANW insulated cable has established an enviable operating record in network service. Under extreme exposure to moisture and other adverse conditions, ANW has performed without a single reported failure.

The remarkable characteristics of this type of insulation, principally moisture-resistance, were soon recognized as ideal for other uses, particularly where heretofore only lead sheathed cables had been applicable. After careful tests, Underwriters' Laboratories has now given approval for the use of this type cable in *moist locations without lead sheath.* See letter below.

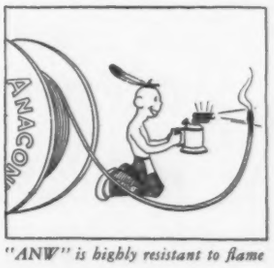
Easily identified, this cable is plainly marked every foot as illustrated—for installations under jurisdiction of the National Electrical Code.

Important economies are possible by using ANW insulated cables for your next job. 38425

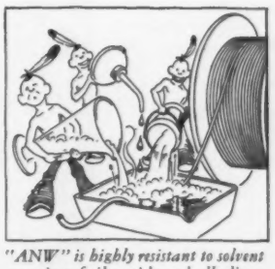
SEND FOR BOOKLET DESCRIBING THESE IMPORTANT IMPROVEMENTS IN CABLE



"ANW" is highly resistant to moisture



"ANW" is highly resistant to flame



"ANW" is highly resistant to solvent action of oils, acids and alkalis

"ANW" is easily handled in extreme temperatures

ANACONDA
from mine to consumer

USE MODERN IMPROVED

Anaconda Wire & Cable

ANACONDA WIRE & CABLE CO. • *General Offices:* 25 Broadway, New York • *Chicago Office:* 20 North Wacker Drive • *Sales Offices in Principal Cities* • Subsidiary of Anaconda Copper Mining Company

Installations of Automatic Electric Water Heating for "Steam" Cleaning in Garages, Service Stations, etc.

Tank Size Gal.	Average Consumption Mo.	Kw.-Hr.	Use
40	8	194	On each major repair job to clean engines, differential, transmission, etc. Cleans *used* cars before resale.
40	9	322	Cleans parts, car washing.
40	7	242	Thawing frozen brakes, radiators, warming motors. Cleans shackles before greasing.
40*	15	339	Washes grease rack, floors and parts. Hot water for wash room. Does not use "gun."
40*	8	100	Cleans motors, parts, grease rack.
52	7	163	Cleans gas engines. Also home laundry use.
52	2	740	Cleans motor, chassis, car washing.
52	9	586	Car washing only. No "gun".
40*	8	418	Motors. Also cleans oil off car bodies before repainting.
40	6	375	Clean motors and parts. Occasional car washing.
66	9	192	Cleaning motors, parts, washing cars. Thawing radiators and brakes.
40	4	420	Motor cleaning, car washing.
82	6	443	Motor and parts. Washing cars—mixed with cold water.
52	7	320	Motor cleaning lavoratory.
52	7	285	Motor, parts cleaning, washing cars, lavoratory.
52	5	384	Car washing *only*.
40	5	377	Car washing only.
82	8	1,100	Car washing—100 cars per month. Occasional cleaning motors, chassis.

* Non-adjustable thermostats.

Roy C. Whipple, architect, both of the company, have so perfected their technique of consolidating and digesting facts pertaining to a particular proposed kitchen that they can turn out a recommendation—in the form of a folder for the customer, complete with illustration—in two hours. Furthermore, their recommendations are hard to improve upon.

Results of such a program are hard to measure, especially in a case like the above, where alterations and improvements in the program have been going on continually. In the Idaho territory, however, a steadily increasing acceptance of the electric idea by new home builders is testifying to the program's success.

•

Tests Usage of Commercial Heaters

By A. H. WEGNER
Manager Commercial Sales,
Washington Water Power Company,
Spokane

Sales of an automatic off-peak type water heater to small garages, service stations and car washing establishments will bring an average consumption of 370 kw.-hr. per month, according to a recent survey of eighteen such installations on the lines of the Washington Water Power Company. Experience indicates that the tendency is to undersell as regards tank capacity, for when the operator learns what the installation does in the way of reducing labor a standard 40-gal. tank usually will not provide sufficient storage. No tanks smaller than 52 and preferably 66-gal. should be sold.

This particular market for water heaters grew out of an installation in a small service-station garage where a substitute was desired for the more expensive steam-producing cleaning installations. By employing a mixture of hot water and compressed air a satisfactory substitute for steam was produced for use in washing car motors and other grease-incrusted parts. A DeVilbiss type "CW" air-water washing gun is the medium used for producing the stream of "steam."

Operating data on eighteen of some 25 installations made in Washington Water Power territory are shown in the table above.

• • •

Luminous Front Goes Rural

By W. J. FETZER
Lighting Division,
Cincinnati Gas & Electric Company

Walker's Coffee Shop is interesting in that it typifies a practical attempt at a luminous store front with a minimum cost.

This installation has converted an uninviting red brick store which had lost all eye appeal into an easy-to-see eat shop. In this country town of 1,800 population, where there are comparatively few, if any, light spots, this location is a beacon for all villagers who enjoy that late snack, not to mention the additional stops by tourists and hometowners for evening dinner.

Gratifying results have been reported since this installation was made, consisting of 76 15-watt lamps spaced on 9-in. centers. The front unit is 22 ft. in length and the side 10 ft. Both are 9 in. deep with 18-in. face. Water-tight access panels are on top of the unit. An imaginative before picture can be found in this illustration. Note the opal glass globe.

Thousands of small commercial customers in hundreds of country towns can build business for themselves and for utilities by inexpensive luminous fronts, similar to this one promoted by Cincinnati Gas & Electric

THE WIRE THAT MADE ELECTRIC HEAT POSSIBLE

Better TODAY THAN EVER

Chromel, discovered 32 years ago, is better today than ever before—because of continuous research, and a policy of re-investment of profits in the latest equipment. Hence, the heating-appliance industry, and its dealers, have always had high confidence in Chromel for heating-elements.

HOSKINS MANUFACTURING COMPANY • DETROIT • MICHIGAN

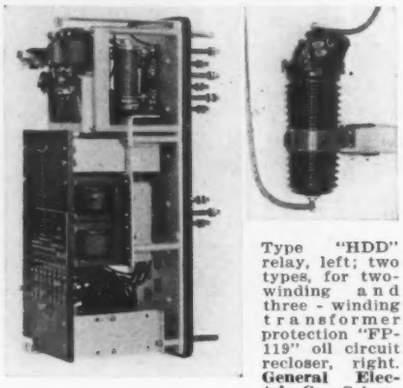
Chromel

CHROMEL HEATING ELEMENT WIRE

New EQUIPMENT AVAILABLE

Protective Equipment

New protective devices announced by this company include: (1) A 15-kv. oil circuit recloser for maintaining service on suburban and rural lines and (2) a



Type "HDD" relay, left; two types, for two-winding and three-winding transformer protection "FP-119" oil circuit recloser, right. **General Electric Co.,** Schenectady, N. Y.

high-speed, percentage differential relay for transformer protection. New recloser is instantaneous in operation on overcurrent, provides a three-second time interval before reclosing and operates through a cycle of three reclosures before lock-out. Relay effects a combination of harmonic and percentage restraint principles in operation; average operating time varies from approximately two cycles just above pick-up to less than one cycle above forty times pick-up. Each type has two electrically separate circuit-closing contacts, one of which is provided with a series target. Each contact will make currents up to 30 amp., but this current must be broken externally.

•

Voltage Regulator

"Voltrol" voltage regulator for panel mounting; a.c. voltage range 0 to 135. **Acme Electric & Mfg. Co.,** Cuba, N. Y.

New, more compact, panel type voltage control is offered to fit as an integral part of modern electrical testing apparatus. Basically, the unit consists of a heavy-duty auto-transformer, with self-lubricating rheostat contacts that tap the individual turns of the winding, to provide a more accurate control of the output voltage.

•

Wiring Device

"Hinjon Junior" combination tee-parallel tap. **Thomas & Betts Co.,** Elizabeth, N. J.

New universal type tap is offered by this company in three body sizes to take any type of wire, cable or tubing from 1/0 to 500,000 circ.mil on the main and Nos. 14 to 4 on the branch. Tap is of one-piece construction and only slightly larger than the cable, over insulation, for ease in taping.

•

Rubber Insulation

"Simplex-ANHYDREX AA-LL" rubber insulation for wires and cables. **Simplex Wire & Cable Co.,** Cambridge, Mass.

Low water absorption, high electrical qualities, long life and heat resistance are said to be combined, for the first time, in this 60 per cent rubber insulating compound. It is thus a heat-resistant insulation suitable for submarine service or a submarine insulation suitable for high-temperature service. With increased heat resistance, it is said also to allow increased current-carrying capacity, by reason of the higher allowable conductor temperature.

•

Electrode for Cast Iron

"Softweld" electrode; size, 5/32x16 in. **Lincoln Electric Co.,** Cleveland, Ohio.

This company has brought out a heavily coated "shielded arc" electrode designed for depositing a soft machinable alloy on cast iron. Its suggested uses include correcting machining errors, filling up defects, producing a very soft, machinable, drillable weld in grey cast iron.

•

Oil Circuit Breaker

A manhole-type oil circuit breaker is a recent addition to this company's line. A submersible breaker for use in underground distribution systems, it may be used outdoors. Automatic features may consist of 1, 2 or 3 trip coils and bushing-type current transformers.

Class "50-M Turblator" oil circuit breaker; 200, 400 and 600 amp., 7.5 kv.; 50,000 kva. interrupting capacity. **Roller Smith Co.,** New York, N. Y.

Electroplating Kit

As a construction and maintenance aid for the electrical utility and industrial fields, this company has recently developed a rapid electroplating process. Designed

"Rapid Electroplater;" industrial kit, No. 750, shown; thickness of silver platings range from 0.0001 to 0.002 in. **Rapid Electroplating Process, Inc.,** 1414 South Wabash Ave., Chicago, Ill.

chiefly for service in repairing worn plated parts without dismantling the equipment, the scheme makes use of plating compounds which have a jelly-like consistency and are applied directly to the object by brush. Current for plating is supplied by a transformer-rectifier which plugs into a 110-volt a.c. circuit, or may be obtained from dry cells. Silver plating of contact surfaces is a suggested electrical equipment application; silver contact surfaces for aluminum are said to be under test.

•

Industrial Lighting Unit

"Locklite" hood; embodied in standard industrial reflectors. **Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa.

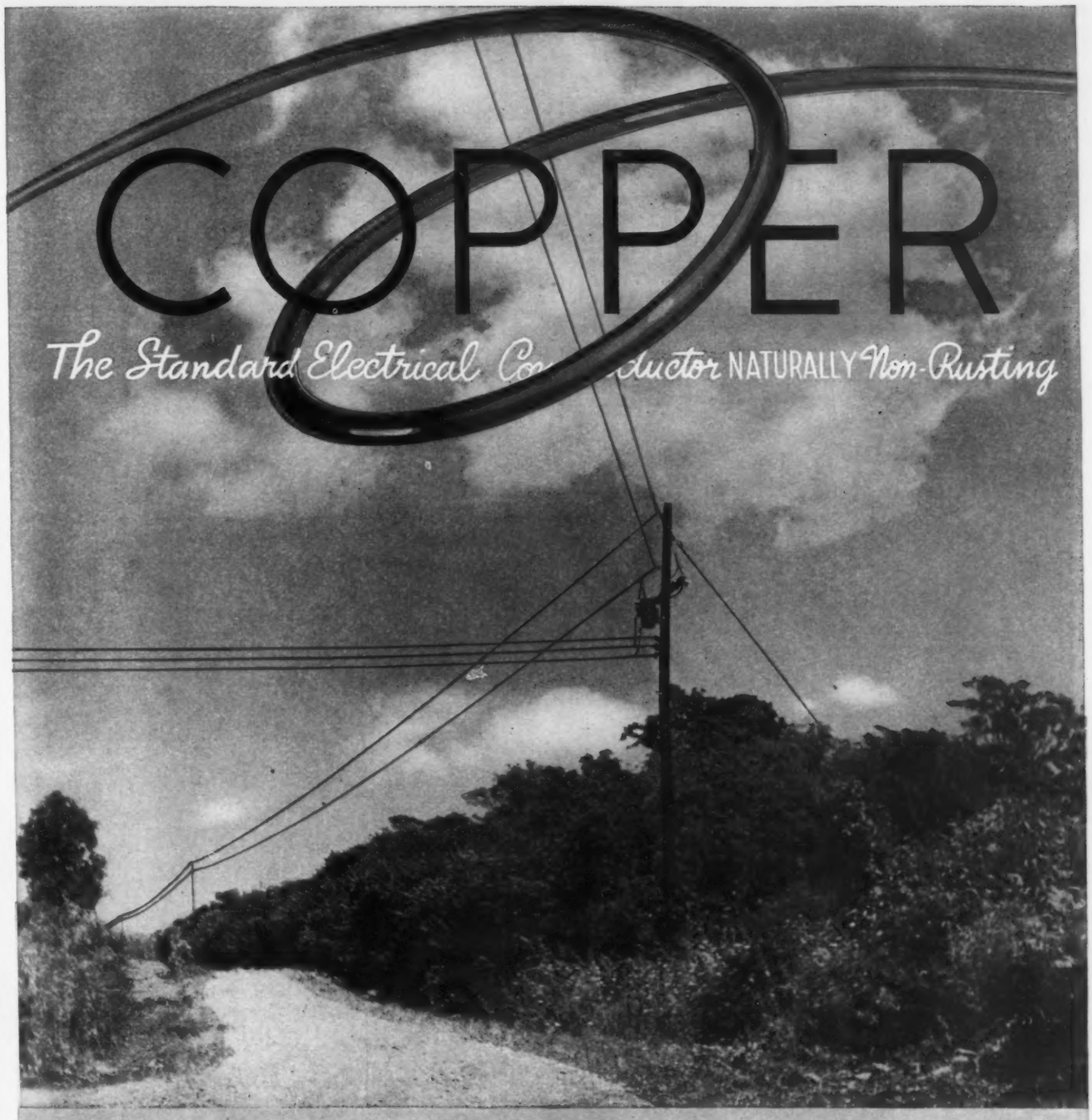
With a new electric and mechanical disconnecting device for industrial reflectors, it is said to be impossible to light the lamp until the reflector is locked in place. Each unit consists of two parts—a hood and a receptacle into which the reflector with lampholder fits. When the lugs on the neck of the reflector lock into the slots of the hood the electrical connection is made. This is accomplished by giving the reflector a clockwise turn of 60 deg.

•

Welding Cable

"Kickless" cable; in four sizes. **Clark Controller Co.,** Cleveland, Ohio.

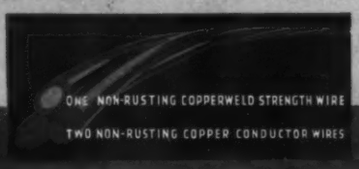
Special electrical construction of this water-cooled cable is said to permit the passage of about 50 per cent more welding current than is passed by separate cables



HIGH STRENGTH COPPER CONDUCTORS ARE COMPLETELY NON-RUSTING

WISE conductor selection asks that there be NO rustable wires in high strength conductors; that both the "strength wires" and the "conductor wires" have the *rust resisting* life of COPPER.

On this Copper Rural Power Line, built with Copperweld-Copper, the rugged three wire conductors are completely non-rusting. *Each* wire in this stranded conductor has all the rust resisting life of Copper.



COPPERWELD STEEL COMPANY GLASSPORT, PENNSYLVANIA

COPPERWELD-COPPER
THE HIGH STRENGTH COPPER CONDUCTOR

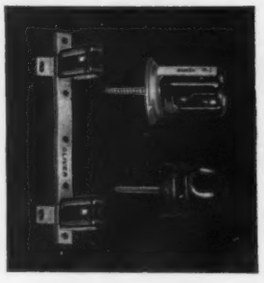
OLIVER

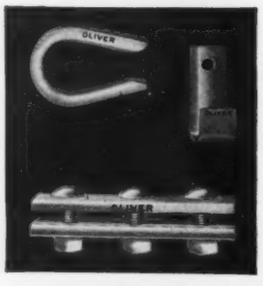
Pole Line Material

PERFECTED PRODUCTS OF OVER FORTY YEARS OF ENGINEERING AND RESEARCH

DOUBLY PROTECTED *against* WEATHER EXPOSURE

Maximum protection against the constant attacks of the elements is assured by the double-thick coating of zinc spelter applied by the Oliver Special Hot Galvanizing Process. That is why Oliver has been a standard specification among economy-minded transmission line engineers for more than 40 years . . . why Oliver Pole Line Materials deliver the maximum service per dollar invested.





ESTABLISHED 1863

OLIVER IRON AND STEEL CORPORATION

PITTSBURGH · PENNSYLVANIA

OLIVER POLE LINE MATERIALS

APPROVED AND ACCEPTED SINCE 1894

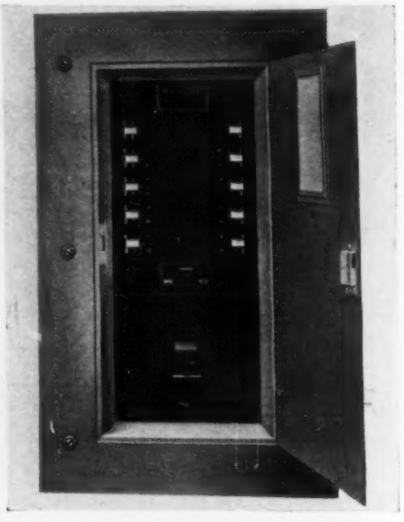
OLIVER

of comparable size. It is intended for connection between the secondary taps of a welding transformer and a portable welding gun. Around the central rubber core are helically wound, flexible, tinned copper cables. For alternate polarity, these cables are separated by a corrugated live rubber spacer, the whole inclosed in a flexible, wire and woven fabric reinforced, rubber tube. This construction permits circulation of cooling water in direct contact with the stranded copper cable.

•

Circuit Breaker Panels

New circuit breaker panels are offered for commercial, industrial and institutional use. Type illustrated is shown with



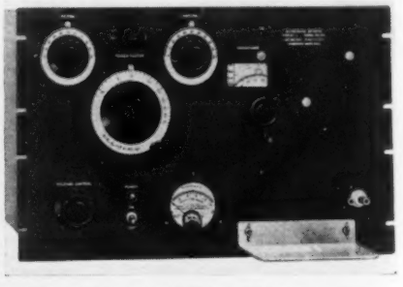
Type "NMM" "Multi-breakeR" panel; various types equipped with adjustable mountings for the interiors. **Square D Co.**, Detroit, Mich.

main circuit breaker, but is also available with main lugs only. It can be secured with any number of single-pole or double-pole breakers in branches, except that any one panel is limited to 40 breaker poles.

•

Schering Bridge

Used to measure the dielectric properties of insulating materials at powerline frequencies, this bridge includes in its applications the testing of materials used as



Type "671-A" Schering Bridge; power input, 30 watts from a 115-volt, 60-cycle line. **General Radio Co.**, Cambridge, Mass.

dielectrics in capacitors and as insulation in transformers, cables and electrical machinery. A substitution method of measurement is used; voltage applied to the sample under test can be varied between 0 and 1,100 volts. Capacitances up to 1,000 m.mfd. can be measured with an accuracy of plus or minus 1 m.mfd., it is claimed; for small samples, power factors up to 80 per cent can be measured.

EVEN LUTHER BURBANK *Couldn't make* ROCKBESTOS "BLOOM"

The old horticultural magician, if he were alive today, could saturate a Rockbestos insulated cable with all kinds of oil—rub it down with thick gooey grease—day after day—but he'd never be able to make it "bloom."

Rockbestos insulation, made of inorganic asbestos is inert to the blooming, swelling and rotting action of oil, grease and corrosive fumes. It has greater resistance to insulation-destroying agents than any other type of wire you can buy, and in addition is absolutely heatproof and fireproof. Coal mines, refineries, chemical plants, heat-treating and engine rooms are only a few of the places where Rockbestos is used in permanent, money-saving installations.

If the wire you are now using is failing under severe conditions replace it with Rockbestos. If you want to try before you buy send for test samples. Rockbestos Products Corporation, 907 Nicoll St., New Haven, Conn.

IF YOU HAVEN'T SENT IN FOR YOUR COPY OF THE NEW NO. 10-E BULLETIN . . . WRITE TODAY!

OTHER ROCKBESTOS FEATURES

IT HAS GREATER CARRYING CAPACITY

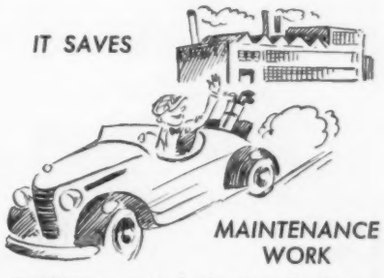
Rockbestos' greater carrying capacity saves conduit replacement, labor and money.

IT IS HEATPROOF

Rockbestos insulation, made of asbestos, does not deteriorate under heat. It's flameproof, too.

IT IS PERMANENT

Rockbestos is always "as good as new" because asbestos is naturally time-resistant.



IT SAVES MAINTENANCE WORK

Rockbestos wired circuits eliminate frequent and expensive replacement.

IT IS VIBRATION-PROOF

Rockbestos insulation won't dry out, crack, open up, or fall off.

ROCKBESTOS A.V.C.—*the wire with permanent insulation*

ROME-CABLE
ROME, N.Y.

Inquiries are solicited for

HOT ROLLED COPPER RODS

BARE and TINNED COPPER WIRE
(In rounds, flats and squares)

BARE and TINNED STRAND

URC WEATHERPROOF WIRE

COTTON, PAPER and ASBESTOS MAGNET WIRE
(In rounds, flats and squares)

RUBBER INSULATED WIRES and CORDS

LEAD COVERED CABLES

NETWORK CABLES

SERVICE ENTRANCE CABLES

ROME "60"

That New Tough 60% Jacketed Heavy Duty Portable Cord

●

ROME CABLE
CORPORATION
Ridge Street
ROME, N. Y.

●

SALES OFFICES:
New York Chicago
Cleveland Pittsburgh Boston
Richmond Philadelphia
Los Angeles

Conduit Bender

Bending or straightening steel conduit is included in the applications of this new portable hydraulic-powered unit, which will

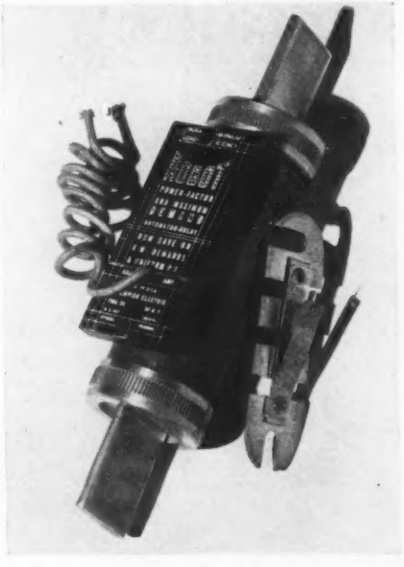
"Porto-Power" pipe and conduit bender; bending shoes handle 1-, 1¼-, 1½- and 2-in. diameter conduit or tubes. **Blackhawk Mfg. Co.**, Milwaukee, Wis.

operate in horizontal, vertical or angular positions. An automatic retracting ram is used; it is said to develop 10 tons of power. The tool is intended for cold-bending work.

●

Automatic Fuses

A bimetallic strip is attached to the fuse element in this new renewable-type fuse. As the temperature of the fuse link increases with load, one end of the strip moves away from the link to close a contact, giving an alarm at a predetermined load, which may be from 75 to 125 per cent of fuse rating. Time-delay characteristics are built in the fuse to make overfusing unnecessary.



"Robot" fuses; in knife-blade terminal sizes from 61 to 600 amp., voltages up to 600. **Champion Electric Fuse Co.**, 784 Broadway, New York, N. Y.

●

Transmission Cable Tester

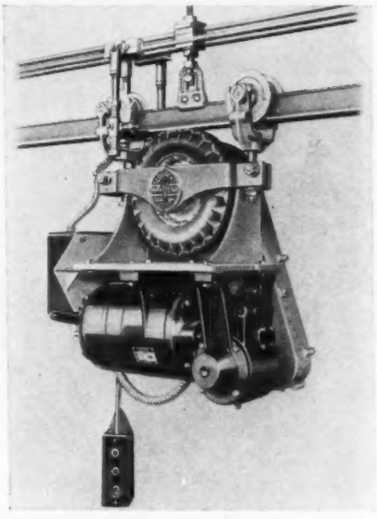
"Insulation Compactness Tester" (see also Electrical World, November 5, 1938, page 82). **Central Scientific Co.**, Chicago, Ill.

Working in conjunction with engineers of the Detroit Edison Company, this company has developed an instrument for testing for mechanical uniformity of solid-type, high-voltage underground power transmission cable. Both torsion and penetration tests are made with the one instrument, a separate mechanism being provided for each measurement. In the torsion test the torque required to twist a small flat needle, inserted between adjacent layers of insulating paper, through a small angle, is measured. In the penetration test a weight is dropped through a standard distance to drive a needle into the insulation.

●

Overhead Conveyor

A rubber tire serves as the drive wheel on this new conveyor, for use in automatically transporting loads over an overhead track system. Drive shaft is supported in ball bearings on each side of this wheel and the motor is mounted under the main frame. Unit is said to be perfectly balanced with-



"MotoVeyor;" speed range from 60 to 600 ft. per minute. **Louden Machinery Co.**, Fairfield, Iowa.

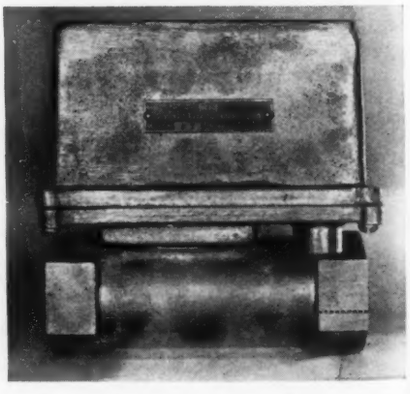
out the addition of counterweights to make it hang plumb. It may be built into cab or step on platform, so that the operator can accompany the loads, and may also be used in power-driven cranes.

●

Electric Switch

This pressure switch was developed to handle materials that would solidify if trapped in a pipe line or valve casing and allowed to cool. The diaphragm actuating the switch is at the casing and allows material to drop away freely when flow ceases. Switch mechanism is the customary over-center snap-action type; switches are offered to open or close on rising pressure.

"Figure 271" pressure switch; for two standard pressure ranges, 8 to 140 lb. and 15 to 245 lb.; in two sizes, 1 and 2 in. **Ruggles-Klingemann Mfg. Co.**, Salem, Mass.



Manufacturing AND MARKETS

Orders Big Turbines for Grand Coulee

Three 150,000-hp. turbines have been ordered by Secretary of the Interior Harold L. Ickes for the Grand Coulee Dam power plant. Two contracts were awarded for furnishing and delivering electrical apparatus. One was awarded to the Newport News Shipbuilding & Dry Dock Company on its bid of $1,477,200 for the three vertical-shaft hydraulic turbines for units L1, L2 and L3 in the left powerhouse at Grand Coulee Dam. The other was awarded to the Woodward Governor Company, Rockford, Ill., on its bid of $67,854 for three oil-pressure, actuator-type governors, with pumping equipment, for regulating the speed of the turbines.

The initial power development will include the completion of the left power house and the installation of the three main generating units and two station-service generating units, and will include also the construction of the foundation for the right power house. It is expected that the first unit will go into operation in January, 1942.

•

New Refrigerating Standards

Equipment standards have recently been published by the Refrigerating Machinery Association, according to an announcement by its Washington office. These equipment standards represent the first of a series to result from the broad standardization program which the association initiated a year or so ago.

•

Domestic Copper Shipments Reach New High in October

Domestic stocks of refined copper were reduced 25,781 tons during the month of October, totaling 267,299 at the end of the month. This reduction was due largely to a sharp increase in deliveries to domestic customers, which amounted to 69,827 tons in October, the largest for any month since June, 1937, as reported by the Copper Institute.

Producers are reported as seeing deliveries maintained at a satisfactory rate, with a few in the industry expecting November shipments to compare favorably with those of last month. Mine output rose in October and is scheduled further to increase in November.

•

Ten-Month Earnings Statement Issued

The following manufacturing companies have recently issued reports on operations:

CATERPILLAR TRACTOR—Net profit for ten months ended October 31 totaled $2,421,496 after expenses, depreciation, interest and provision for federal income taxes. Net profit for corresponding months of 1937 amounted to $9,686,508. Net sales for the 1938 period $41,331,330, against $57,906,054 for the similar period last year. For October the company showed a net profit of $349,395 and net sales totaling $3,870,253. This compared with a net profit of $550,572 and net sales of $3,500,495 reported for October, 1937.

CONTINENTAL - DIAMOND FIBRE—Nine months to September 30: Net loss, $603,920, contrasted with net profit last year of $377,504. September quarter: Net loss, $166,794, contrasted with $53,878 earned in similar quarter a year ago.

•

Electrical Exports Increase in October Over September

Exports of electrical machinery and apparatus during October totaled $9,190,000, against $7,299,000 in September and $10,254,000 in October last year, according to the Department of Commerce. For the first ten months these exports amounted to $84,325,000, against $93,627,000 in the corresponding period a year ago.

Exports of household refrigerators during October amounted to 12,752 units, valued at $974,000, as compared with 12,057 units, valued at $989,000, in September and 10,296 units, valued at $864,000, in October last year. For the first ten months exports totaled 124,593 units, valued at $9,437,000, as against 149,198 units, valued at $11,211,000 in the same period a year ago.

Electric Apparatus Ordered by Ickes

Turbines, governors and generators for the Elephant Butte power plant, Rio Grande project, New Mexico-Texas, and the Green Mountain power plant, Colorado-Big Thompson project, Colorado, have been ordered by Secretary of the Interior Harold L. Ickes.

Three vertical-shaft, 11,500-hp. hydraulic turbines for the Elephant Butte power plant and two vertical-shaft, 15,000-hp. hydraulic turbines for the Green Mountain power plant will be furnished by the Newport News Shipbuilding & Dry Dock Company on its bid of $128,470 and $97,790 respectively.

The five governors with pumping equipment for regulating the speed of the turbines for both power plants will be furnished by the Woodward Governor Company of Rockford, Ill. Contract was awarded on a bid of $35,919 for the three at Elephant Butte and $23,946 for the two at Green Mountain.

Allis-Chalmers Manufacturing Company was awarded the contract for the generators—three 9,000-kva., vertical-shaft, alternating-current generators for the Elephant Butte and two 12,000 kva. of the same kind for Green Mountain.

All of the apparatus will be installed by the Bureau of Reclamation, which is in charge of the construction of the Elephant Butte and Green Mountain power plants.

•

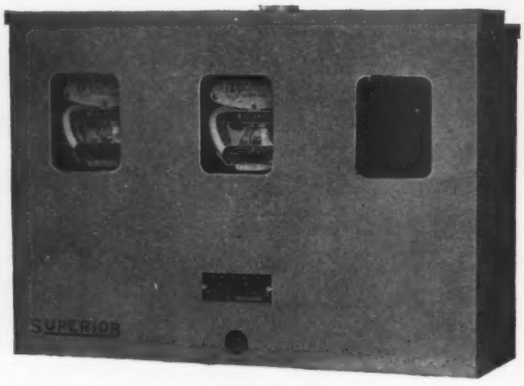
Westinghouse Sees Better Business in Near Future

Although there has been no definite upturn in the amount of business on the books of Westinghouse Electric & Manufacturing Company, "it is confidently expected that improvements will be noticed in a relatively short time," the company stated in a Thanksgiving proclamation to employees and stockholders. "The future looks brighter," it was stated.

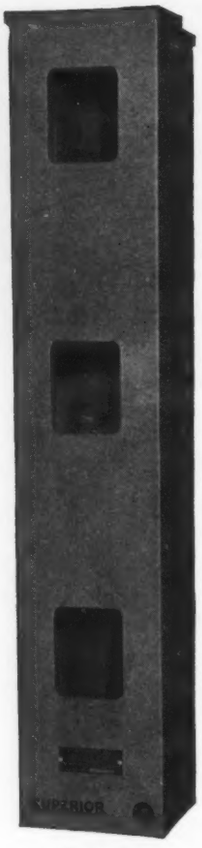
The company pointed out that there

MULTIPLEX OVERALL METER ENCLOSURES

(for ganging single phase meters)



(Fig. C)



(Fig. E)

Multiplex Overall Meter Enclosures are made in a variety of styles and sizes to meet requirements.

The multiplex method of ganging single phase meters saves space, gives full protection and is easily and economically accomplished.

Write for information on Superior Overall Meter Enclosures.

Superior Switchboard & Devices Company

CANTON, OHIO

*Been at it Since 1920

SUPERIOR

REG. U. S. PAT. OFF.

are 42,806 employees on the payroll of the company and that employees received an extra 3 per cent in November under the company's wage and salary plan.

•

Manufacturers Make Sales Assignments

Manufacturing companies have recently announced the following assignments to their sale staffs:

Triangle Conduit & Cable Company has appointed Donald W. Droll representative in the states of Michigan, Ohio, West Virginia and Kentucky, east of Frankfort, with headquarters in Detroit. Mr. Droll has been connected with the Westinghouse Electric & Manufacturing Company, for twelve years was with Clayton-Mark Company of Chicago, and more recently has been doing special sales work for the Wheeling Steel Corporation.

Ohio Brass Company announces that Claude R. Kingsbury, with headquarters in Seattle, Wash., will take over the territory formerly handled by J. W. Watkins, who is leaving the employ of the company. Mr. Kingsbury has been with the company since 1927, first at the Barberton insulator plant where he was in charge of the electrical laboratory, and more recently at the Mansfield plant on street railway and trolley coach engineering.

R. E. Uptegraff Manufacturing Company, Pittsburgh, Pa., has announced the appointment of F. T. Materson as representative in the Detroit territory, with headquarters at 13336 Livernois Avenue.

•

Electric Truck Shipments

Domestic shipments of electric industrial trucks and tractors, as reported by ten manufacturers, representing the entire industry, totaled 33 for October, as against 51 in September and 163 in October last year, according to the Department of Commerce. For the first ten months domestic shipments amounted to 574, as compared with 1,473 in the same period a year ago.

•

Orders Hiwassee Dam Unit

Westinghouse Electric & Manufacturing Company has secured an award from the TVA for a 64,000-kva. generator unit and accessories to be installed in hydro-electric power plant at Hiwassee Dam.

New York Metal Prices

	Nov. 22, 1938 Cents per Pound	Nov. 29, 1938 Cents per Pound
Copper electrolytic	11.25*	11.25*
Lead Am. S. & R. price	5.10	5.10
Antimony	12.25	12.25
Nickel ingot	35.00	35.00
Zinc spot	5.14	5.14
Tin straits	46.00	45.625
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.

Field Reports on Business

Expanding trade over the next few months is indicated by the volume of orders being placed for electrical equipment. Brisk buying is noted in some lines, while in others a seasonal lull is being experienced. Manufacturers report that inquiries are more active for heavy equipment.

NEW YORK

The seasonal lull in business in some lines is not expected to be of long duration as the Christmas rush will speed up production. Utility purchases have been slow, but this is attributed in part to work on the filing of integration plans with the SEC. Another factor holding back utility buying on a large scale is methods of financing.

Westinghouse told employees and stockholders in a Thanksgiving proclamation that a definite upturn in business is expected in the near future. Other manufacturers also are optimistic regarding the future. Inquiries have been more active of late, with the expectation that specifications will soon be completed for actual placing of orders. Estimates on 1939 utility construction budgets vary considerably, but a total larger than this year is expected.

Retail outlets are revising upward their expectations on Christmas trade. Meetings here indicate that the improvement will be countrywide and is likely to provide the impetus to carry over well into the spring. Opinion is general that private spending must take up the slack when the government begins to curtail. Efforts to carry this out is seen in the drive to put private funds to work.

NEW ENGLAND

Central Maine Power Company has purchased an 8,000-kva. vertical type generator from the General Electric Company for installation at its new Solon hydroelectric plant. Interest in electrical power equipment in this district is encouraging; small motor orders are in good volume. Crompton & Knowles, Worcester, Mass., has begun shipment of a large order for 300 rayon looms for England; sixteen escalators, each driven by a 10-hp. motor, with a capacity of 96,000 passengers per hour, have been installed by G. Fox & Co.'s department store, Hartford, Conn. This company also has installed a Plainville Electrical Products Company switchboard 35 ft. long.

New substation apparatus for a 1,500-kva. substation in Hingham, Mass., will be bought soon. About $2,200 was involved in equipment to be used for additions and extensions to substations in the Maine area, according to one representative.

An announcement that the Procter & Gamble Company will erect a large soap works on Fore River, Quincy, Mass., presages some attractive orders for both mechanical and electrical machinery. During the past week a contract was made with Quincy (Mass.) Light & Power Company for electric dredging in the Town River involving a load of 1,200 kw.

A nationally known furnace manufacturer reports an increase in inquiries for small heat-treating furnaces up to 50 kw. This company sold five furnaces for mid-West delivery recently and reports negotiations pending for several to be used in the machine tool industry. Wiring contracts continue to receive attention and requirements for supplies amount to considerable volume. During the past week Boston Edison output reached an all-time one-day record of 4,164,335 kw.-hr.

PACIFIC COAST

Brisk buying in an unusually early holiday season is reported and wholesalers are thus hopeful of reorders to replenish dealers' Christmas stocks. Leading major appliances are radio receiving sets, with emphasis upon better consoles and refrigerators. Aided by warm November weather, approximately $15,000,000 in line construction work and substation additions is foreseen in the Pacific Northwest because of Bonneville and Grand Coulee service extensions, the Aluminum cable order of approximately $1,000,000 being the largest of its kind ever placed.

Mare Island Navy yard records a $170,889 award for its radio transmitting station and a $600,000 machine shop job. The War Department is to construct a $3,700,000 hospital at Fitzsimmons, Colo., and a $1,500,000 air corps barracks for 3,200 men at Hickam Field, Hawaiian Islands. San Francisco has awarded a $53,960 electrical contract for its new 400-bed hospital. Some good direct and indirect industrial plant machinery business is reported, topped by a $450,000 order from Pacific Gas & Electric Company covering switchgear for three steam plants it is erecting at Avon, Martinez and Oleum to handle loads of nearby oil refineries. Other switchgear orders totaled $60,000 for Hawaiian sugar plantation service and $20,000 for a northern California match plant. The price market is becoming fairly stable and has been strengthened by 10 per cent advances in staple items rather than complete lines.

CHICAGO

The various branches of the electrical industry report business moving steadily forward, week after week. Sales of industrial apparatus have registered substantial gains over the past three months. Orders for industrial and commercial lighting equipment show considerable improvement, although the level remains under last year. Appliances are moving at a more rapid pace, the smaller items making an especially good showing. Wire and cable sales show moderate gains and pole line hardware is more in demand.

REA allotments made in the past week total $1,200,000 for line construction in several down-state counties. PWA contracts recently awarded include $425,000 for electrical equipment. Other orders reported last week include motors and control apparatus, transformers and conveyers to cost approximately $500,000. Electric power output was slightly below the previous week but 2 per cent above the comparable week last year.

Of 47 manufacturers reporting sales to the Electric Association for October, 25 show an increase over September, while 33 report a decline from October, 1937, Residential building in the city and suburbs last month increased 41 per cent over the same month last year. An encouraging sign was the sharp upturn made in retail trade throughout the Middle West, sales passing last year's level by 1.5 per cent.

Activity in the steel mills district continues to gain.

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SOLDERLESS LUGS...

- LOW COST
- PRACTICAL
- STRONG
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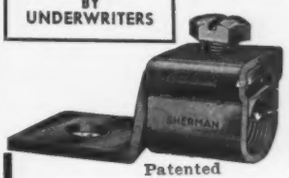

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UNIT ASSEMBLY PURE COPPER

Screw can't come out
Rigid assembly
No loose parts
Easy and quick to use
No special tools required
Lighter and stronger than cast lugs
Grips wire at all points
Send for samples and bulletin No. 15

SOLDERING LUGS

A Complete Line

SEND FOR TRADE BULLETIN NO 21

TWO-HOLE HEAVY DUTY

FOUR-HOLE HEAVY DUTY

- Correctly made
- Smooth inside and out
- Made from heavy copper tubing

H. B. SHERMAN MFG. CO.

BATTLE CREEK MICHIGAN

News ABOUT PEOPLE

REA Appoints M. M. Samuels Chief Operations Engineer

M. M. Samuels has resigned from the Federal Power Commission to become chief operations engineer for the Rural Electrification Administration, reporting to C. A. Winder, director of operations. Mr. Samuels has been with the FPC since July,

1934, engaged successively in the electric rate survey and as rate engineer for the New York regional office.

He is responsible for the glossary of power terms adopted by the commission and for a report on special power contracts, as well as for the chapter on power transmission and distribution in the National Resources Committee's report on technological trends. Prior to his government experience he was for twenty years connected with the J. G. White Engineering Corporation.

•

▶ J. F. O'BRIEN, who recently resigned as manager of the advertising, sales promotion and publicity departments of the Westinghouse Electric & Manufacturing Company, has been appointed director of electrical research for the John B. Pierce Foundation, New York. The foundation was incorporated in 1924 for the purpose of research, educational, technical or scientific work in certain designated fields "for the increase of knowledge to the end that general hygiene and comforts of human beings may be advanced."

▶ JAMES DIXON has been appointed assistant general manager and chief engineer of the Ridgway (Pa.) works of the Elliott Company. This plant was formerly the Ridgway Dynamo and Engine Works.

▶ ERNEST T. ANKELE of Victoria, Tex., has been named as general superintendent of operations of the Lower Colorado River Authority. Mr. Ankele will be in charge of production and distribution of power, the physical operations of the system and maintenance. He has been serving in a similar capacity with the Central Power & Light Company for nearly twelve years.

▶ H. J. MAUGER, assistant to the president of the Edison General Electric Appliance Co., Inc., Chicago, was unanimously re-elected to the chairmanship of the electric range manufacturers' section of the National Electric Manufacturers' Association, at the recent annual meeting. He was chairman of the heating device section of N.E.M.A. for six years, when that section included the electric range manufacturers.

▶ JAMES D. MORTIMER, member of the executive committee of the North American Company, has resigned as director of that company and its subsidiaries, North American Edison Company and Union Electric Company of Missouri. Mr. Mortimer also resigned as vice-president of Union Electric.

Mr. Mortimer, formerly president of the North American Company, also held office as a vice-president or director, or both, in many other companies of the North American System. He was president of the North American Company from 1914 until 1920, being only 35 years old when he was made chief executive. He resigned as head in 1920. In later years he has served in an advisory capacity as a vice-president and director in various companies of the system.

Lee Clark Heads Committee of Modern Kitchen Bureau

Lee Clark, advertising and sales promotion manager of the Frigidaire division of the General Motors Sales Corporation, will become chairman of the plan committee of the Modern Kitchen Bureau on January 1. He will succeed Roger Bolin, Westinghouse

Electric & Manufacturing Company, chairman of the plan committee this year.

Prior to his appointment as Frigidaire sales promotion manager, in 1933, Mr. Clark was identified with the Fort Wayne Engineering & Manufacturing Company.

•

▶ R. A. BALZARI, president of the McGraw-Hill Company of California, resigned, effective December 1, in order to devote more time to his work as sales and marketing counselor. HOWARD EHRLICH, executive vice-president of the McGraw-Hill Publishing Company, Inc., has been elected to succeed him. Mr. Balzari has been retained as publishing counselor for both *Electrical West* and the McGraw-Hill Publishing Company and will remain on the board of directors of the California subsidiary, so that his sales and marketing experience will be available to the company and its ad-

TURBINE TROUBLE SPOTS

AND HOW TO FIND THEM

well known to the specially trained and experienced Engineers of the "Ocean" and "Columbia" Insurance Service

The value of intelligent and analytical inspection of power equipment at regular intervals is well recognized by power plant operators. To be effective when applied to steam turbines, this service must be rendered by trained specialists ● The engineers whom the "Ocean" and "Columbia" Companies entrust with this work are recruited from the industries of the country where they have attained a background of practical operating experience. Each one is given a thorough course of training in the construction, repair and maintenance of steam turbines at plants of the largest turbine manufacturers, and finally, instructed in the particular requirements of accident prevention and defect detection. They come to your plant with a background of knowledge and experience that comes from the inspection of numerous machines and intimate contact with their failures ● Modern turbines are subjected to high steam pressures and temperatures. They must withstand the heavy stresses set up by rapid rotation. Failures are possible—and do occur—in spite of exacting construction and elaborate safety devices ● Since these and many similar possibilities must be faced by every turbine operator *your* turbines should not be operated without the complete protection of "Ocean" and "Columbia" Turbine Insurance ● Your own Insurance Advisor will furnish full information.

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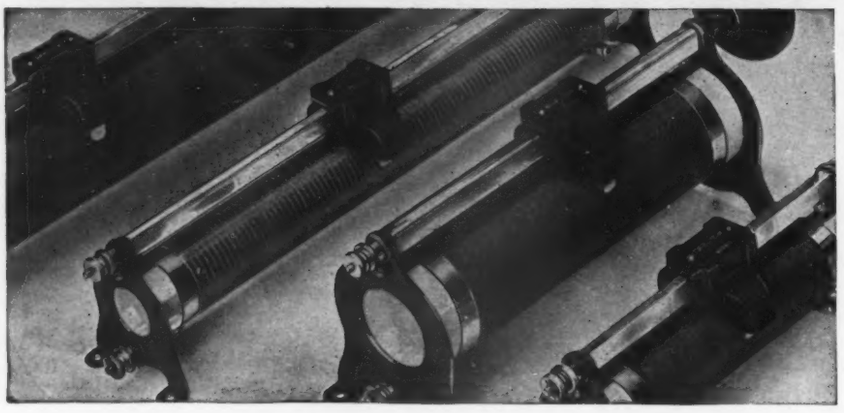
"JAGABI" Rheostats



For fine adjustment and control of electric current, Jagabi Rheostats are quality instruments of great ruggedness and durability. They are widely used both for engineering and laboratory purposes and for close regulation of electrical equipment and electrically controlled manufacturing processes. There are four sizes in seventy-six standardized ratings, and numerous special types such as for switchboard mounting, for high voltages, etc.

Please write for descriptive Bulletin 1515-W.

JAMES G. BIDDLE CO.
ELECTRICAL AND SCIENTIFIC INSTRUMENTS
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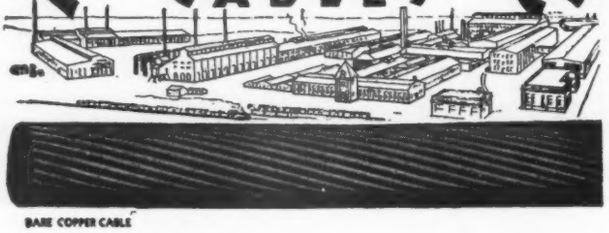

BARE COPPER CABLE

POWER CABLE
PAPER INSULATED
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BARE COPPER WIRE AND CABLE
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MAGNET WIRE
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"QUALITY ABOVE SPECIFICATIONS"

KENNECOTT WIRE AND CABLE COMPANY
SUBSIDIARY OF KENNECOTT COPPER CORPORATION
PHILLIPSDALE, RHODE ISLAND
New York, 10 East 40th St. - Chicago, 140 South Dearborn St. - Cincinnati, Traction Bldg.

vertisers. Mr. Ehrlich has had broad experience in the publishing field in the electrical industry. He started the Electrical Trade Publishing Company, publisher of the *Jobbers' Salesman*, in Chicago, and later purchased *Electrical Contracting*. Shortly after these publications were purchased by McGraw-Hill he was placed in charge of all the company's electrical magazines. He became executive vice-president of the company in 1937.

▶ J. E. SHEEHAN has become associated with the transformer division of Line Material Company, and will act as sales engineer in the South, making his headquarters at Houston, Tex. He has been connected with subsidiaries of Electric Bond & Share for a number of years, and was chief engineer for the Houston Lighting & Power Company, prior to his recent appointment.

▶ J. F. CALVERT has become professor of electrical engineering at Northwestern University, Evanston, Ill. Previously professor of electrical engineering at Iowa State College, Ames, he was once associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, for thirteen years, and was lecturer at the University of Pittsburgh during his affiliation with the Westinghouse company.

▶ WALTER JEFFREY has been promoted to the position of assistant general sales manager of the Leonard refrigerator division of the Nash-Kelvinator Corporation. Mr. Jeffrey has been with the corporation for nearly nine years in various executive capacities in both the advertising and sales promotion departments. He joined Kelvinator in 1929 as household sales promotion manager. Later he became advertising and sales promotion manager of Leonard. For the past few months he has served as acting director of advertising and sales promotion for Kelvinator.

▶ WILLIAM V. KING, chief accountant for the Federal Power Commission since its organization in 1920, was presented on November 22 with an engrossed copy of a resolution passed unanimously by the commission on the occasion of his recent retirement, expressing its appreciation of his work as one of the foremost public utility accountants in the country. Mr. King, who was born in Wolfe City, Tex., in 1872, began his governmental career in May, 1909, with the Interstate Commerce Commission. He was transferred to the War Department in 1920 and detailed as chief accountant of the first Federal Power Commission soon thereafter. He was long active

in the battle for a uniform accounting system for the electric industry, being a member of the first committee that promulgated such a system in 1922, and also playing a prominent part in the more recent system that was adopted in 1936 and effective January 1, 1937.

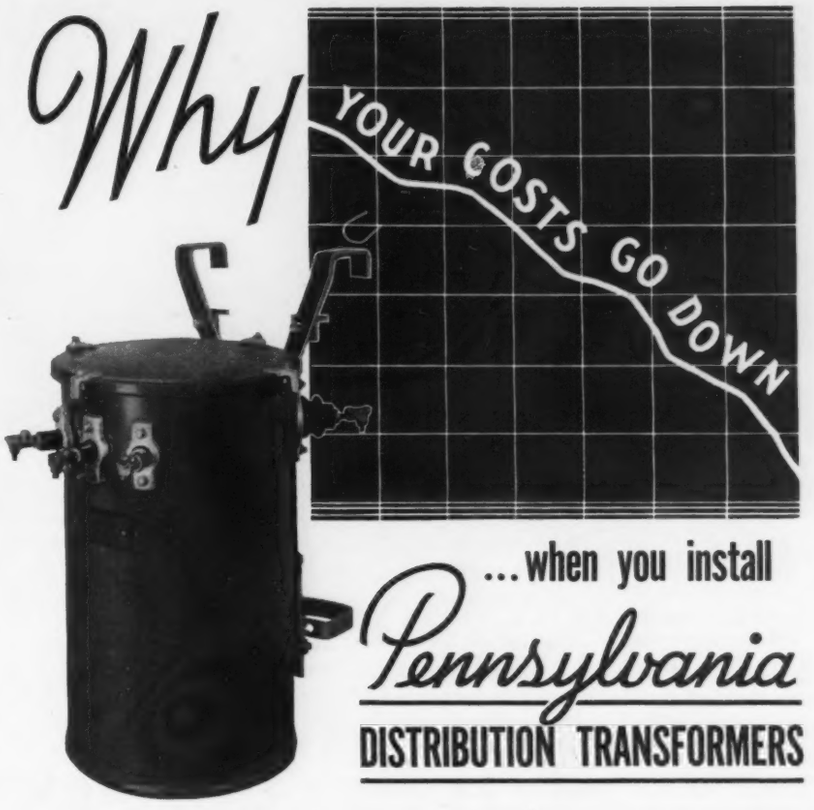
▶ J. PETER EASTMAN has been re-elected president of the Wisconsin Public Utilities Commission at Manitowoc. HARRY F. KELLEY was elected vice-president of the commission and ERWIN K. FANTA, secretary while Walter C. Staeffler was named assistant secretary. Other members of the commission are Harvey Kono and Oscar Anderson.

▶ ROBERT A. JONES, engineer at General Electric Company's Buffalo office, has been appointed assistant engineer for the company in the New York district. W. C. PLUMER of the G. E. Newark office goes to Buffalo as engineer and L. F. STONE becomes engineer at the Newark office of the company. Mr. Jones has been with General Electric since 1916 and has served in the Schenectady, Syracuse and Buffalo offices. Mr. Plumer joined the organization in 1921 and was located at Schenectady before going to Newark in 1929. Mr. Stone entered the G. E. test course at Schenectady in 1920. Since 1922 he has been in the New York district.

▶ EDWIN W. LANDMEIER, chief engineer of the Wadsworth Electric Manufacturing Company, Covington, Ky., has been elected a member of the board of directors. His association with the company began in the engineering department in 1921.

▶ W. H. DENNISON has been appointed sales manager of domestic refrigeration for the Universal Cooler Corporation. For five years Mr. Dennison was sales manager of the department store division of the Norge division, and for the past year has been sales manager of the Detroit Vapor Stove division, Borg-Warner Corporation, from which position he resigned to accept this new appointment. Mr. Dennison is well known in the refrigeration field, having organized the Dayton Refrigeration Corporation and served as its vice-president and sales manager in the pioneer days of electric refrigeration.

▶ BEN A. CLARK, electrical engineer, Plymouth Motor Corporation, has been elected president of the Industrial Electrical Engineering Society, a Detroit organization. After receiving his electrical engineering degree from the University of Toronto in 1921, Mr. Clark engaged in power house construction in Ontario. In 1926 he joined the Chrysler



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DISTRIBUTION TRANSFORMERS

● To executives interested in lower maintenance costs, Pennsylvania's fundamental improvements are bound to appeal, especially since these costlier refinements are offered without extra cost to the user. We believe they merit your consideration for 1939!

1 POWER TYPE FEATURES

Pennsylvania uses CIRCULAR coils in ALL distribution transformers, the same type as offered in power transformers. Such coils are balanced radially and axially to resist short-circuit stresses . . . *thus promoting longer life!*

2 SAFE PLIABLE INSULATION

Being of the open type, these circular coils are treated in VARNISH, instead of compound. Treating temperature is limited to 105°C, . . . *thus keeping insulation safe and pliable.*

3 CONVENIENT BUSHING ATTACHMENT

Pennsylvania's stud-type bushings are bolted from exterior, eliminating necessity for handling tools inside tank . . . *thus providing ease of maintenance.*

4 OVERLOADS WITH SAFETY

Pennsylvania's open type coil construction results in low temperature gradient between copper and oil, . . . *thus permitting higher overloads with safety!*

5 NEW STURDY TANK CONSTRUCTION

Pennsylvania recently introduced a round tank with curled top and locked seam-weld bottom, thus providing ideal bearing for gasket and a triple thickness of metal at bottom where tank is subject to greatest abuse.

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Pennsylvania

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DENSE LONGLEAF PILING, POLES & LUMBER PRESSURE TREATED WITH CREOSOTE OR "WOLMAN SALTS"

—you're getting "DIXIE" dense longleaf yellow pine Poles—unsurpassed for uniform strength and durability. Furthermore, you'll find them in exact accordance with your specifications. If they are not for you, why not let us quote on your requirements?

"DIXIE" Poles, Piling and Construction lumber . . . . all dense longleaf yellow pine . . . are available untreated or pressure-treated with Creosote or "WOLMAN SALTS" preservative; also pre-fabricated to specification.

JACKSON LUMBER COMPANY
LOCKHART, ALABAMA
A CROSSETT WATZEK GATES INDUSTRY

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GALVANIZED PRODUCTS

SPECIFIED BECAUSE OF PROVED PERFORMANCE

Crapo Galvanized Steel Strand has earned its enviable reputation for long, dependable, economical life by outstanding performances in actual service. That's why it so often is specified by leading utilities for the more important construction jobs. The heavy, uniform, pure zinc coating—applied by the *Crapo* Process—is notable for its adhesion and ductility; its ability to withstand bending and twisting; its lasting resistance to corrosion. Both the finished strand, and the wire from which it is made, conform in every detail to the most rigid specifications for tensile strength, elongation, size, galvanizing and ductility.

Crapo Galvanized Strand is readily available in all standard grades and sizes. Ask your Jobber, or write direct for technical details!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Corporation in Detroit and in 1928 he transferred to Plymouth.

OBITUARY

H. C. Abell

Harry C. Abell, prominently identified with the Electric Bond & Share group of public utilities from 1921 until his resignation in 1933, died in New Orleans, La., November 24, after a week's illness. He was 69 years of age.

Mr. Abell became a vice-president of the Electric Bond & Share Company when he joined the system in 1921 and he served as president of the National Power & Light Company from the time of its formation in 1925 until his retirement from active business five years ago. In addition to these executive offices, he relinquished his position as director of National Power & Light Company, vice-president and director of Electric Power & Light Corporation, as director and chairman of the Memphis Power & Light Company and as vice-president and director of the New Orleans Public Service Company.

A native of Winnipeg, Man., and a graduate of the Armour Institute of Technology, Mr. Abell was connected with the Canadian Pacific Railway, the Belding Motor Company of Chicago, Canadian General Electric Company, the Anchor Line and the International Navigation Company. Later he joined Emerson McMillin & Company, which supervised public utility companies, and later served with American Light & Traction Company, which was sponsored by the McMillin interests.

For a number of years Mr. Abell took an active interest in the activities of the National Electric Light Association, having served as treasurer, and also in the American Gas Association, of which he was a past-president. He was also a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and the Engineering Institute of Canada.

•

▶ DR. EDWIN H. HALL, professor emeritus of physics at Harvard University, discoverer of the so-called Hall effect in magnetism, long director of the Jefferson laboratory and an outstanding authority on the structure of metals as revealed by electrical, magnetic and heating tests, died at Cambridge, Mass., on November 20. He was born at Gorham, Me., 83 years ago; was educated at Bowdoin College and Johns Hopkins University and taught at Harvard for 40 years. He was a member of many learned societies.

THE BIG 3 OF *insulation!*

3 SIZES

TYPE 660 . . . FOR VOLTAGES UP TO 8,000
TYPE 670 . . . FOR VOLTAGES UP TO 10,000
TYPE 680 . . . FOR VOLTAGES UP TO 15,000
Handle most PRIMARY line requirements

■ On line after line they're going up! The three great HEMINGRAYS! They're *tough;* age doesn't mark them. They're *strong;* they defy rigorous service. They're *versatile;* efficiency remains constant. They're *economical;* they reduce initial and over-all costs to a minimum. They're *competent;* they overcome outage loss. All in all, these great new HEMINGRAY Glass, brass-bushed insulators provide a life of better insulator service than has ever been known before. Send for samples—subject them to the most gruelling tests—then watch them *deliver.* Owens-Illinois Glass Company, Hemingray Division, Muncie, Ind.

World's largest manufacturers of glass containers; and producers of INSULUX Glass Block, DUST-STOP Replacement-Type Air Filters, FIBERGLAS Insulating Wool, Insulating Blankets and Electrical Insulation.

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Reliable
STRAIGHTLINE
DEAD ENDS

Flexible clevis Straight-Thru type FD—A compact and convenient low cost unit.

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Straightline Splice adapter type DD—For economy in stocking.

Rigid clevis type D—Compact and economical.

Reliable Straightline Dead Ends include design features of the Straightline Splice. Straight-Thru type permits easy take-up of slack.

Reliable
ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
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Sales Opportunities

PENSACOLA, OKLA.—Grand River Dam Authority, City Hall, Vinita, Okla., receives bids until December 20 for furnishing and installing following equipment at hydroelectric generating station on Grand River, near Pensacola; Main generator and feeder control switchboards, relay switchboard, oil circuit breakers and power distribution transformers with complete accessories, as required for power house and switchyard; also for construction of switching station and relay house in switchyard, including three 16,000-kva. power transformers and auxiliary equipment; oil purifying, ventilating, heating, water and lighting systems for power station and switchyard structures; all wiring, cable and conduit installations; all necessary piping, with valves, fittings, etc.; complete auxiliary equipment required to complete power plant and switchyard ready for operation (Contract 12). Holway & Neuffer, 302 East Eighteenth Street, Tulsa, Okla., are consulting engineers; R. V. L. Wright is general manager.

BLUFFTON, OHIO—Central Ohio Light & Power Company, Findlay, Ohio, has secured permission to arrange a note issue of $127,923, fund to be used for installation of new generating unit and auxiliary equipment in power plant at Bluffton.

MOORHEAD, MINN.—Has plans maturing for expansion and improvements in municipal electric power plant, including installation of new 3000-kw. generating unit and auxiliary equipment. Cost about $196,000, to be secured through bond issue, recently voted, and Federal aid. Helmick, Eduskuty & Lutz, Essex Building, Minneapolis, Minn., are consulting engineers.

HASTINGS, NEB.—Central Nebraska Power and Irrigation District, St. Joseph and Third Streets, Hastings, receives bids until December 30 for construction of Johnson Canyon No. 1 power plant, complete with intake and penstocks, and canal drop into reservoir (Item No. 1); for construction of Johnson Canyon No. 2 power plant, likewise to include intake and penstocks, and canal drop into reservoir (Item No. 2); for electrical equipment for Johnson Canyon and Jeffrey power plants (Item No. 3). George E. Johnson is chief engineer and general manager.

PERRY, OKLA.—Has plans nearing completion for extensions and improvements in municipal electric power plant, including installation of new equipment. Cost about $82,000. Financing has been arranged through Federal aid. V. V. Long & Company, Colcord Building, Oklahoma City, Okla., are consulting engineers.

MOBILE, ALA.—Gulf Shipbuilding Corporation, Mobile, T. M. Stevens, vice-president and general counsel, plans installation of motors and controls, transformers and accessories, electric hoists and other equipment in connection with modernization and improvements in former local plant of Chickasaw Shipbuilding & Car Company, recently acquired for new shipbuilding and repair works. Cost reported over $300,000. D. R. Dunlap is chairman of board, and E. A. Roberts, president. Alabama Power Company, Birmingham, Ala., operates a power plant under lease with former owner on adjoining property, and will continue this station, as heretofore, for reserve service in Mobile area. Also will furnish power for shipyard operation.

EAST PALESTINE, OHIO—Receives bids until December 9 for extensions and improvements in municipal electric power plant, including installation of additional equipment. F. S. Barckhoff, Sr., City Hall, Salem, Ohio, is consulting engineer.

ATLANTA, GA.—Atlanta Water Works will take bids soon for equipment for extensions and improvements in waterworks pumping station and power house, including one 175-kw. turbo-generator unit with complete accessories; two 550-hp. boiler units, with mechanical stokers and auxiliary equipment; one electric-operated pumping unit, capacity 40,000,000 gallons per day; and miscellaneous equipment. Cost estimated about $215,000. W. Z. Smith is general manager.

PINE BLUFF, ARK.—Arkansas Power & Light Company has authorized work on new power dam on Ouachita River, where hydroelectric generating station will be located, to be carried out over a period of 36 months. An appropriation of about $4,500,000 will be arranged for project.

OWENSBORO, KY.—Glenmore Distilleries Company, 660 South Fourth Street, Louisville, Ky., plans installation of motors and controls, regulators, conveyors, loaders, electric hoists and other equipment in connection with rebuilding portion of main distillery at Owensboro, recently destroyed by fire, comprising a group of six one and multi-story buildings. Loss close to $1,000,000.

WHITEVILLE, TENN.—Plans early construction of a transmission line for connection with high-tension system of TVA, from which power will be secured, with power substation in municipality and other operating facilities. Project has been approved and bond issue will be arranged soon.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until December 12 for following equipment for power substation at Greeley, Colo.: One control switchboard, two 115,000 to 115-volt outdoor-type, oil-immersed, potential transformers; two 115,000-volt 100-200 to 5-amp., outdoor-type, oil-immersed, current transformers; nine 1,000-volt, 400-amp., single-pole, hook-stick operated, outdoor-type disconnecting switches; three 46,000-volt, outdoor-type expulsion fuses; one 115,000-volt, 600-amp., three-pole, single-throw outdoor-type oil circuit breaker; and seven 115,000-volt, 600-amp., three-pole, manually gang-operated, outdoor-type disconnecting switches. Also for equipment as follows for power substation at Cheyenne, Wyo.: One control switchboard, two 10-kva. and one 15-kva., 13,200 to 120-240-volt distribution-type transformers; two 13,800 to 115-volt outdoor-type, dry potential transformers; six 400 to 5-amp., 13,800-volt, outdoor, dry-type current transformers; twelve 15,000-volt, 400-amp., single-pole, hook-stick operated, outdoor-type, disconnecting switches; one 15,000-volt, 400-amp., three-pole manually gang-operated, outdoor-type, disconnecting switch; three 15,000-volt, outdoor-type, expulsion fuses; one 15,000-volt 600-amp., three-pole, single-throw, outdoor-type, oil circuit breaker; and one 15,000-volt, three-pole, station-type lightning arrester. Both substations are in Kendrick, Wyo. project. All equipment will be installed by Government (Specification 1146-D).

CLEVELAND, OHIO—Republic Steel Corporation, Republic Building, Cleveland, plans installation of heavy-duty motors and controls, regulators, conveyors, electric hoists and other equipment for expansion and improvements in mills at Cleveland, Warren and Youngstown, Ohio, and Gadsden, Ala. Appropriation of $1,250,000 has been authorized for project, larger part of fund to be used for new unit at Gadsden mill for production of special welded iron products for construction service.

Electrical Goods Orders Reach New High for Year

New orders booked for electrical goods during the third quarter, as reported by 78 Manufacturers, amounted to $158,958,951, a new high for the year, according to the Department of Commerce.

This total compares with $157,315,411 for the second quarter and $215,963,847 for the third quarter of last year. For the first nine months orders were $470,427,921, against $747,864,009 in the corresponding period last year.

•

Apex to Spend $100,000

Announcement has been made that the Apex Electrical Manufacturing Company will transfer to Cleveland the production that has been carried on in its Oakland, Calif., factory and will spend more than $100,000 in the next three months for plant improvements at Cleveland. Completion of this project will enable Apex to increase its present production 25 per cent. Company's sales have shown a considerable increase in recent months, according to President C. G. Frantz, and, "as signs point to continued improving business conditions, we are convinced that now is the time to prepare our company to take full advantage of this opportunity."

•

Street Lighting Contract

Announcement has been made that the Street Lighting Service Company, Inc., Chicago, has been awarded a contract by the City Council of Wauwatosa, Wis., at $66,800 for the installation of an ornamental street-lighting system on a number of main thoroughfares in the downtown and adjacent districts, including ornamental standards, underground conduits, feeder lines and accessories for complete installation.

•

Line Material Issue Sold

Announcement has been made that an issue of 90,000 shares of common stock of Line Material Company, recently offered at $15.75 per share, has been all sold and the books closed promptly after being offered.

•

Resumes Dividend Payment

Johns-Manville Corporation has resumed dividends on the common stock by declaring a dividend of 50 cents a share, payable on December 23. The last previous dividend was 75 cents a share, paid on December 24, 1937.

INSULATING TUBING

DILECTO *phenol fibre*
DIAMOND VULCANIZED FIBRE
CELLULAC, VULCOID
MICABOND *a bonded Mica*

Insulating Tubing has been a special study of the Continental-Diamond Fibre Company. If you have an insulating problem involving the use of tubing we can help you regardless of the type you are now using.

Our equipment for manufacturing tubing of various sizes is most complete. We also have unexcelled facilities for fabricating tubing to your specifications.

Since we manufacture practically every type of laminated insulating tubing—including Mica—our recommendations will be unbiased and you will benefit from our knowledge of thousands of applications of insulating tubing in all industries.

We shall be glad to have an opportunity to study your particular problem involving the use of Insulating Tubing and submit marked samples and quotations whether your requirements be standard lengths, cut pieces or fabricated forms.

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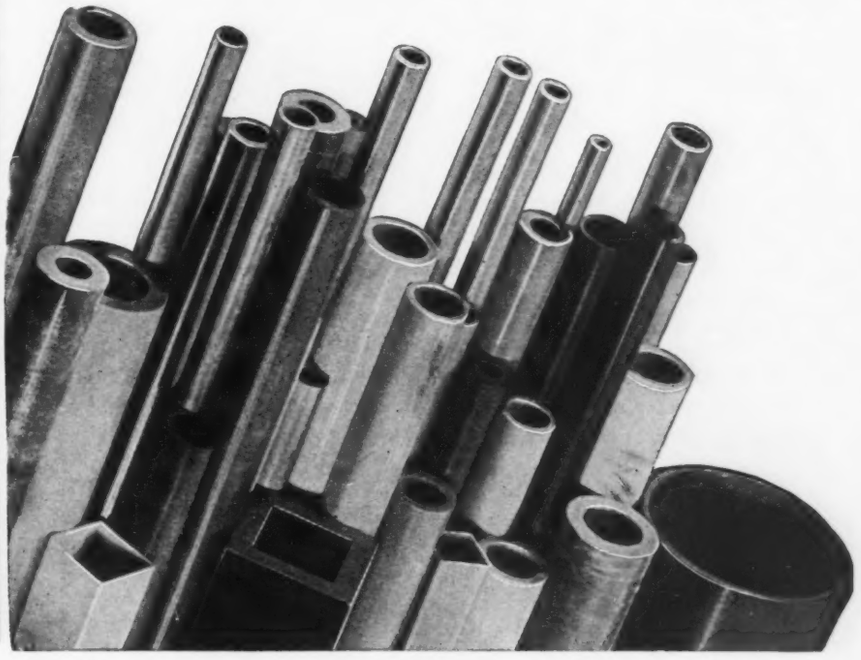
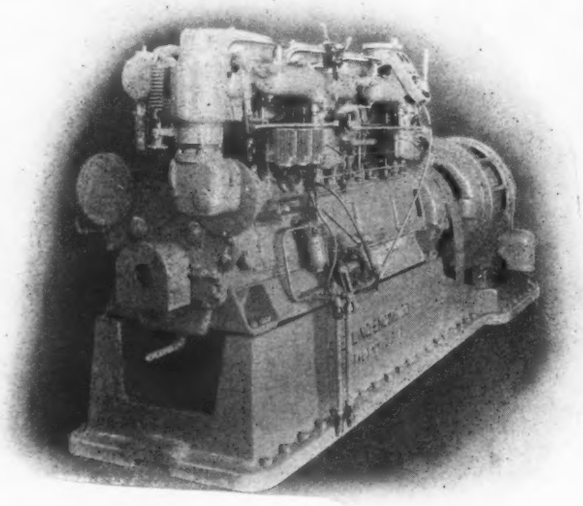
NEWARK, DELAWARE
Represented in Canada by Diamond State Fibre Co. of Canada, Ltd., Toronto



QUICK STARTING ENGINES

Capable of accepting immediate load. Extremely accurate governing. With Underwriters' Laboratory approval. Smooth under load, vibration eliminated—*are essential requirements* for emergency sets for public building installations.



125 K.W. General Electric Generator direct connected to 1200 R.P.M. Sterling Dolphin 8-cylinder 240 H.P. engines, mounted on spring supported bedplate.

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See Our Exhibit at the 13th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, December 5th to 10th.

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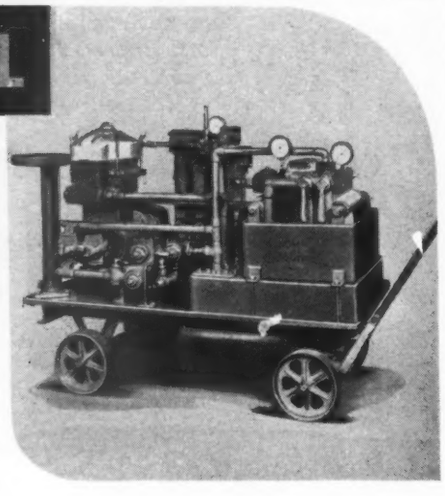
FOR CLEANER OIL AT LOWER COST



To maintain dielectric strength of insulating oils in transformers and circuit-breakers, oil must be kept clean. Goulds Hydroil Centrifugal Oil Purifiers, used periodically, keep oil free from all moisture, dirt, and other impurities—swiftly and at low cost.

These substantially built, well engineered units are available in sizes to meet every requirement. Portable units enable most efficient use. Goulds engineering service, backed by 90 years of experience, is at your service. Write now for Bulletin No. 503.

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8530

Municipal Plants

NEW CASTLE, IND.—Public Service Company of Indiana has filed suit in circuit court asking a permanent injunction against the city's engaging in the business of selling electrical energy.

CASCADE, IOWA—PWA has allotted $49,500 to supplant the bond issue of $60,500 for the erection of a municipal light and power plant, construction of which is to start by January 1.

ANITA, IOWA—By a 422 to 205 vote citizens approved the erection of a municipal light plant. Construction of the plant is to be financed by a federal grant and $111,000 revenue bonds.

CORBIN, KY.—State Court of Appeals reversed the ruling of a Whitely Circuit Court, which held that the city was within its rights to issue $220,000 worth of bonds and accept a grant of $179,000 from the PWA. The grant depended on the city's obtaining the $220,000.

NORTHFIELD, MINN.—Voters have rejected for the second time a bond issue of $195,800 to construct a municipal electric plant which would have put the city in the light and power business. The $195,800 would have financed purchase of a site and erection of the building, while generating and other equipment would have been covered by a PWA grant of $160,200. The bond issue had been previously beaten at a special election in September, when it failed by 210 votes to poll the necessary three-fifths of all ballots cast. Backers of the project then claimed the voters were not aware of the PWA grant, which was approved only a day or two before, and demanded another ballot.

PLEASANT HILL, MO.—Circuit Judge N. G. Sevier has issued temporary injunctions against this town and Eldorado Springs preventing State Auditor Forrest Smith from registering bond issues for municipal electric light systems. The injunctions were sought by the Missouri Public Service Corporation. An $88,250 bond issue was voted by Pleasant Hill September 27, with 682 votes cast for it and 316 against. Eldorado Springs voted a $60,000 issue September 30, with 974 affirmative and 403 negative votes. The utility company contended both elections were illegal.

COLUMBUS, OHIO—Officials have been assured by PWA officials at Washington that the $320,000 grant for a municipal light plant extension would not be withdrawn despite litigation instituted by the Columbus & Southern Ohio Electric Company. The utility has been fighting the proposed extension for four years, and has just appealed to the court of appeals in an attempt to have the recent decision of Common Pleas Judge Charles A. Leach, upholding the validity of the extension, reversed.

PARKVILLE, MO.—Mayor H. A. Dean has announced that the city has definitely abandoned plans for the proposed municipal light and power plant and distribution system. A PWA grant allotted for the $72,000 project cannot be accepted since a $39,600 bond issue to finance the city's share was overwhelmingly defeated when submitted to voters several weeks ago.

MONROEVILLE, OHIO—Village council has refused to act on a petition for a referendum on the proposed construction of an $80,000 municipal electric power plant on the grounds that the petition was not drafted properly. PWA has allotted $35,000 for the plant and council proposed to

finance the remainder of the cost by issuing mortgage revenue bonds.

GONZALES, TEX.—Suit has been filed in the district court in this city by the Central Power & Light Company, asking that the recent election, in which the taxpayers of the city voted to issue bonds in an amount not to exceed $125,000 for the construction of a municipal electric light plant, be held invalid. The petition alleges that 41 votes of the total of 302 votes cast in favor of the issuance of the bonds were illegal.

ELGIN, TEX.—At the general election November 8, citizens voted 142 to 39 to issue revenue bonds with which to build a municipal light and power distribution system, to distribute power from the Lower Colorado River Authority's plant. Cost of the system was not stated.

ROBSTOWN, TEX.—Recent action of the Attorney-General's Department in refusing to approve $275,000 of revenue bonds issued by the city council for the construction of an electric light and power plant has been confirmed by the State Supreme Court. The approval of the bonds was refused on the grounds that the city authorized their issuance by ordinance, whereas an election to vote on the proposal should have been held, or a notice of intended issuance given, the latter carrying the right of a referendum.

WASHINGTON—After hearing final arguments, Federal Judge E. E. Cushman recently ruled that he will hear in Tacoma the $5,000,000 condemnation suit of Public Utility District No. 1 of Cowlitz County, against the Washington Gas & Electric Company. The utility district, which will purchase power from Bonneville, and is seeking to take over all the private company's lines in the county, petitioned to have the case remanded to Cowlitz County Superior Court.

•

Seeks Sender of $1,700

When the South Carolina Electric & Gas Company received a package through the mail containing $1,700, company officials called in G-Men. Norman H. Coit, vice-president and general manager, said the sender did not identify himself and company officials are at a loss as to who sent the money package.

•

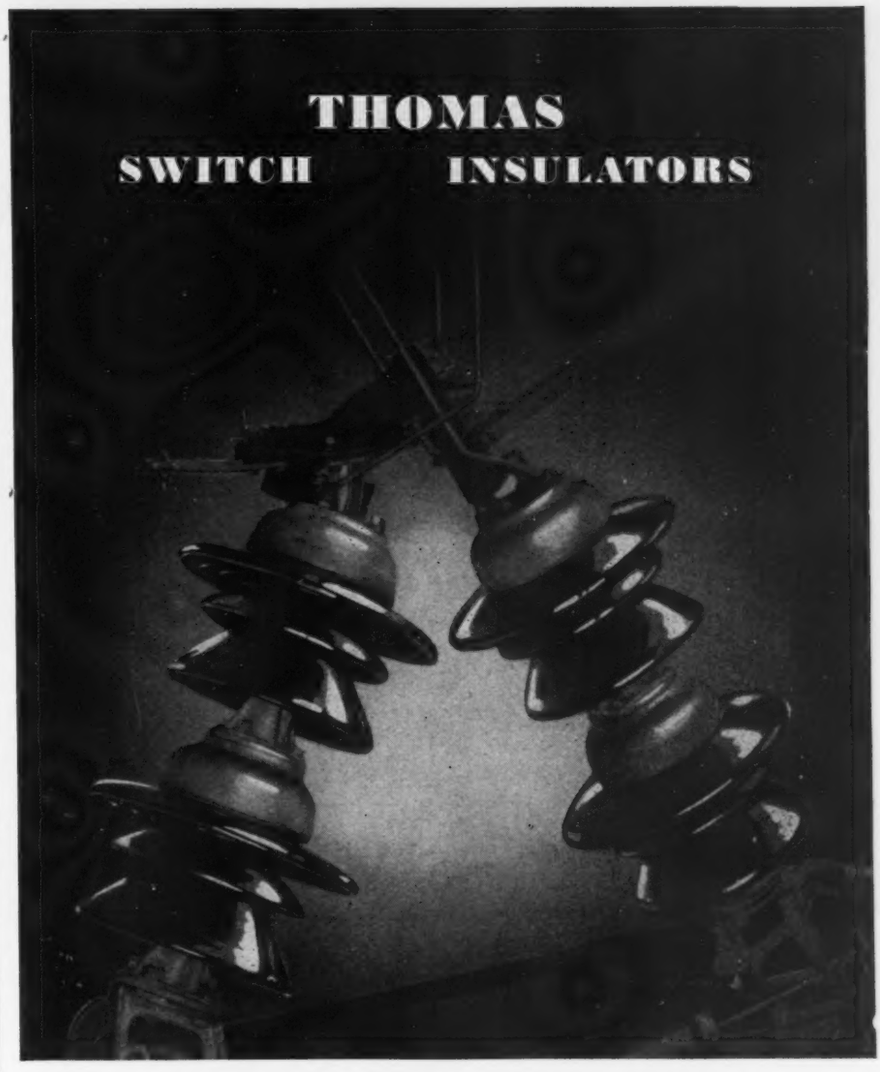
Plan Utility Regulation

Premier T. D. Pattullo has introduced in the British Columbia Legislature a bill which would authorize the government to set up a three-man public utilities commission to regulate various utilities "subject to the legislative authority of the province."

•

Extends Municipal Plant

The village of Solvay, New York, has been granted approval by the state Public Service Commission for the extension of its municipal lighting plant into that portion of the town of Geddes which lies north of the village limits of Solvay.



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- They are carefully and scientifically designed, well balanced and uniform. All manufacturing processes are the most modern science has yet developed.
- Built-in ruggedness enables them to withstand maximum abuse from man and the elements. Their high resistance to impact and remarkable stamina have been proven by years of faithful line service. Mechanical, thermal, and electrical characteristics are well balanced in relation to each other which accounts for their longer life in continuous operation.
- From a most complete line we offer the Engineer a wide choice of designs and sizes. All are improved and modern, representing the best as proved in Factory, Laboratory, and Service Tests.
- Noted for operating faithfully under all conditions, Thomas Switch Insulators from their ability to outlast others will prove more economical in lowering maintenance costs.

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UNDER ONE NAME 'THOMAS'

Ask for our new Switch Insulator Catalog

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A dozen distinctive features give Burndy Bus Connectors the ability to perform under overload, shock, strain and corrosive conditions. On your next job . . . Connect With Burndy!

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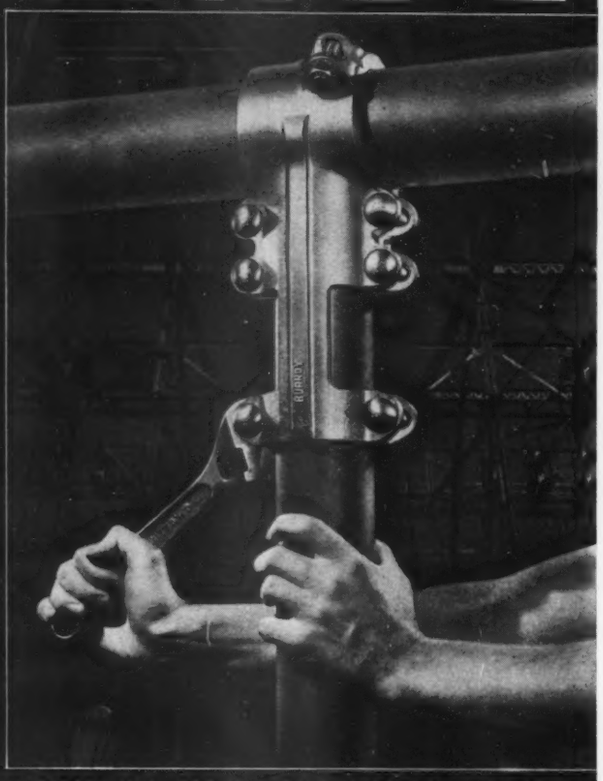

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By G. A. VAN BRUNT and A. C. ROE

281 pages, 6 x 9, 270 illustrations, $3.00

This book presents as simply as possible practical information that will enable engineers and repairmen to modernize older types of alternating-current motors and generators by redesigning and rebuilding their windings as well as replace burned-out or defective windings in present-day designs. Includes the latest information on the properties and applications of the glass-fabric insulating materials that have recently been developed.

Do you want to make a friend a gift combining personal thoughtfulness with real utility? Do you want a copy of this book that you will doubly prize? Then take advantage of this free stamping offer. Send the coupon today (Proper remittance should be enclosed with order and, of course, stamped copies are not returnable.)

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Recent Rate Changes

FLORIDA POWER & LIGHT COMPANY lost a protracted rate case recently when the United States Supreme Court refused to review the action of the lower courts approving a rate reduction of 25 to 33 per cent ordered by the City of Miami in 1933. This means that customers will collect refunds on their bills totaling approximately $4,000,000. The decision upon which the Supreme Court acted gives the power company eight months in which to make the refunds. Chief point at issue in the power company's legal attack to stop enforcement of the city rate ordinance was whether the utility could include in its rate base the value of equipment which lay outside the city, but was used to supply power in Miami.

EASTERN SHORE PUBLIC SERVICE COMPANY has filed with the Virginia Corporation Commission new rate schedules which will result in savings of approximately $20,000 a year to domestic and commercial customers. New rates became effective December 1. In 1934 the commission carried on negotiations with this company, resulting in rate reductions amounting to more than $21.000 annually, affecting the same classes of customers. As a result of further conferences the commission then arranged for reductions in these domestic and commercial rates. The new reductions, therefore, bring the total savings to these customers since 1934 to approximately $41,000 annually.

VIRGINIA ELECTRIC & POWER COMPANY has agreed to "revolutionary" reductions in power rates for counties and municipalities, according to an announcement by Utilities Commissioner Stanley Winborne. New schedules, saving cities 66 per cent of former power costs and eliminating "standby" charges for counties, will be effective January 1. Municipalities will be able to purchase energy for all purposes at one cent per kilowatt-hour, provided they accept a ten-year contract, the Commissioner announced. Counties will get a flat rate of 2 cents per kilowatt-hour under the same contract, and the power company will allow all meter readings to be consolidated into a single bill.

SAN DIEGO CONSOLIDATED GAS & ELECTRIC COMPANY has reduced its electric rates $168,000 annually, the California Railroad Commission has announced.

TACOMA, WASH., municipal light and power plant has reduced materially rates to domestic users and has simplified its rate system by elimination of the complicated house measurement method. The announcement was made by the Tacoma Utilities Commissioner. An easier bond redemption schedule, increasing power consumption and the sound financial condition of the municipal lighting department, make it possible to pass on the benefits to domestic users, the commissioner said. Effective January 1, domestic users will pay per month 4½ cents for the first 20 kw.-hr., 1 cent per kilowatt-hour for the next 400 kw.-hr. and ½ cent per kilowatt-hour for all additional.

•

Buys Power Plant

The New Brunswick Electric Power Commission has purchased the Kouchibouquac power plant and distribution system at a price of $70,000. Extensive improvements are being planned.

Power Systems Modernized For Service

[*Continued from page 45*]

capacity of 150, where instruction and welfare activities may be carried on, and a linemen's change room has been provided with lockers, showers and conveniences for the workmen.

The operating results have been very gratifying and there is reason to believe that rehousing and re-equipping of service organizations will take its place along with central station extensions and substation construction as one of the important items in the immediate future program of the industry.

•

Columbia Set-Up Completed

Personnel for construction of the new $260,000 electric distribution system for Columbia, Tenn., have been named: W. S. Charles, Birmingham, Ala., will be superintendent of the project for Fitz Ziebarth, Omaha, general contractor. Martin Roberts, Jr., will be local representative of the engineers, Freeland, Roberts & Company, Nashville. C. J. Stahl, PWA engineer, will have charge of the Columbia project.

•

Drop Utility Purchase

York, Nebr., City Council, at a special meeting, decided to drop further negotiations for the purchase of the Iowa-Nebraska Light & Power system and to advertise for bids for construction of a municipal plant and distribution system. Cost is estimated at $425,000 and bids are to be received up to December 9.

•

Denies Power Plant Permit

Permission to erect a generating plant has been denied the Hardy County (W.Va.) Light & Power Association by the public service commission. The order directed the Potomac Light & Power Company to furnish the REA-financed cooperative with energy.

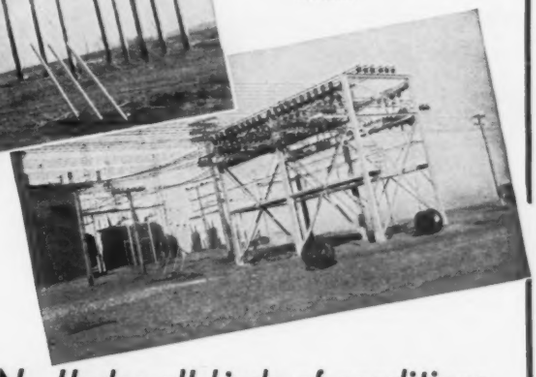
•

Westinghouse Gives Bonus

Westinghouse Electric & Manufacturing Company has declared a 3 per cent profit-sharing bonus for all workers for November. This has been taken to indicate a sharp pick-up in earnings and business during October. Last month there was no bonus because of reduced profits. The profit-sharing bonus is based on earnings of the company for the three preceding months.

• *Wood Pole Structure for 6600 v distribution system forming a turn of ninety degrees.*

• *Steel Switching Tower erected at Fort Peck, Montana.*



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FOUNDED 1890

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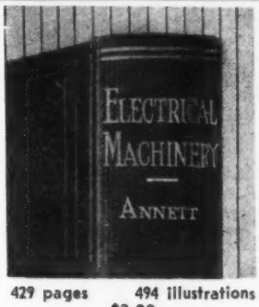

429 pages 494 illustrations
$3.00

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Just Out! *New 2nd Edition*

ELECTRICAL MACHINERY

By F. A. ANNETT, Associate Editor, *Power*

This is just the practical kind of information electricians and power plant engineers everywhere want. It starts from the beginning and goes right along, step by step, until the whole subject of the operation, care and repair of electrical machinery is made clear to you. The first part of the book is devoted to a study of magnetism, properties of permanent and electro magnets and electric circuits. In the following chapters these fundamentals are applied to show how meters operate and how to use them, how d-c and a-c generators and motors, potential and current transformers, and electron tubes and mercury arc rectifiers operate.

Do you want to make a friend a gift combining personal thoughtfulness with real utility? Do you want a copy of this book that you will doubly prize? Then take advantage of this free stamping offer. Send the coupon today (Proper remittance should be enclosed with order and, of course, stamped copies are not returnable.)

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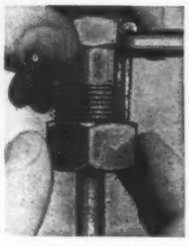

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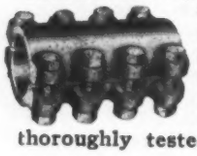

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You'll find it in the *complete* line

PENN-UNION Conductor Fittings

New REA Allotments Amount to $2,736,000

REA has announced allotments totaling $2,736,000 for 19 projects in 13 states. This brings allotments made by REA since it was established in 1935 to $160,564,710, of which $72,845,500 represents operations since July 1, during the current fiscal year. Details follow:

GEORGIA—Satilla Rural Electric Membership Corporation, Valene Bennett, act. supervisor, Alma, $178,000 to build 184 miles of line, 835 customers in Atkinson, Coffee and Bacon counties. Excelsior Electric Membership Corporation, Cleo E. Miles, superintendent, Metter, $152,000 to build 167 miles of line, 718 customers in Candler, Emanuel, Bulloch, Tattnall, Evans and Effingham counties.

ILLINOIS—Illini Electric Co-operative, Vernon C. Green, superintendent, Champaign, $477,000 to build 486 miles of line, 1,394 customers in Champaign, Piatt, Douglas and Vermilion counties.

INDIANA—Northern Indiana Power Company, L. B. Schiesz, president, Indianapolis, $430,000 to extend the company's existing "backbone" lines in Hamilton and Howard counties into an area-coverage system, both by extensions into unserved areas and by fill-in lines to serve dark pockets in the existing coverage.

KANSAS—Sumner-Cowley Electric Co-operative Association, Inc., Harold Koger, president, Wellington, $231,000 to build 270 miles of line, 688 customers in Sumner and Cowley counties.

MISSISSIPPI—Co-operative to be formed, I. P. Moore, Quitman, and Dr. K. J. Wilson, Bailey, correspondents, $368,000 to build 400 miles of line, 1,481 customers in Clarke, Jasper, Lauderdale and Wayne counties.

MISSOURI—Boone County Co-operative Electric Association, A. Dinwiddie, superintendent, Columbia, $135,000 to build 128 miles of line, 350 customers in Audrain, Boone and Callaway counties. Missouri Rural Electric Co-operative Association. H. C. McAfee, manager, Palmyra, $61,000 to build 51 miles of line, 142 customers in Marion and Shelby counties.

MONTANA—Ravalli County Co-operative Electric Association, Thomas Micka, manager, Corvallis, $15,000 to build 10 miles of line, 39 customers in Ravalli County.

OHIO—North Central Farm Bureau Electric Co-operative, Inc., R. J. Williams, superintendent, Attica, $20,000 to build 23 miles of line, 65 customers in Seneca, Wyandot and Sandusky counties.

OKLAHOMA—Southwest Rural Electric Co-operative, Inc., Tom Moran, superintendent, Tipton, $33,000 to build 34 miles of line, 97 customers in Tillman, Kiowa and Jackson counties.

TEXAS—Bowie-Cass Electric Co-operative, Inc., William L. Hubbard, superintendent, Douglassville, $38,000 to build 34 miles of line, 148 customers in Bowie, Morris and Cass counties. Limestone County Electric Co-operative, Inc., Raymond Perdue, superintendent, Mart, $188,000 to build 218 miles of line, 630 customers in Limestone, Freestone, McLennan, Falls, Hill and Robertson counties. Wood County Electric Co-operative, V. B. Shaw, superintendent, Quitman, $195,000 to build 207 miles of line, 849 customers in Camp Franklin, Hopkins, Upshur and Wood counties. Rusk County Electric Co-operative, Inc., E. L. Hightower, superintendent. Henderson, $125,000 to build 150 miles of line, 455 customers in Gregg, Rusk and Panola counties.

VIRGINIA—Craig-Botetourt Electric Co-operative, Clay D. Huffman, superintendent, Newcastle, $30,000 to build 23 miles of additional lines and to add another transformer station.

Allotments of $60,000 were made to finance house-wiring and plumbing installations.

•

Cleaner Group Holds Silver Anniversary

Sales of electric vacuum cleaners during September totaled 102,014 units, compared to 90,557 units in August and 139,024 in September, 1937, the Vacuum Cleaner Manufacturers Association has announced. Sales for the first nine months came close to the million mark, aggregating 940,409, compared to 1,338,436 in the similar period of 1937.

Four founding members active in the industry and the organization were honored at the celebration recently held in Hot Springs, Va., to commemorate the Silver Jubilee of the association. They are Fred Wardell, Eureka Vacuum Cleaner Company, Detroit, first president of the association, who was toastmaster at the Silver Jubilee banquet; Fred Bissell, National Super Service Company, Toledo, first secretary-treasurer and the organization's only honorary life member; H. W. Hoover, the Hoover Company, North Canton, Ohio, and Adam A. Breuer, Breuer Electrical Manufacturing Company, Chicago.

Officers were re-elected and include: President, R. J. Simmons, Birtman Electric Company, Chicago; vice-president, P. A. Geier, P. A. Geier Company, Cleveland; secretary-treasurer, C. G. Frantz, Apex Electrical Manufacturing Company, Cleveland.

•

Italy's Power Output Was 15 Billion Kw.-Hr. in 1937

Electric power production in Italy during 1937 was approximately 15,188,000,000 kw.-hr., of which 14,623,000,000 kw.-hr., or 96 per cent, was generated at hydro-electric stations, according to a recent report by the Central Hydrographic Service of the Italian Ministry of Public Works.

During 1937 there were in operation 1,065 hydro-electric plants with a capacity of 4,445,000 kw. and 195 thermal generating plants with a capacity of 774,300 kw. While there were only 452 generating plants with a capacity greater than 1,000 kw., these plants accounted for an aggregate of 4,930,000 kw., or 94 per cent of the total.

Magnetic Research Gives Revolutionary Transformer

[*Continued from page 37*]

mary consists of a single through conductor—the bushing conductor—and the secondary is of a few volts rating, requiring only ten to a hundred turns, which are wound on the core by hand. Obviously, this would be impractical not only with power transformers but even with distribution transformers running into 2,300 to 13,000-volt ratings and requiring windings of several thousand turns with highly reliable insulation.

It remained for John C. Granfield of Pittsfield, Mass., to solve this puzzle by an ingenious scheme, whereby the heat-treated magnetic roll and the form-wound winding are linked, leaving the core in its original heat-treated size, shape, sequence of turns

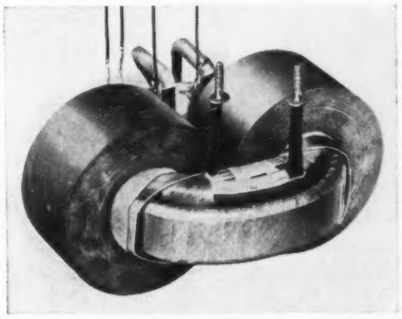


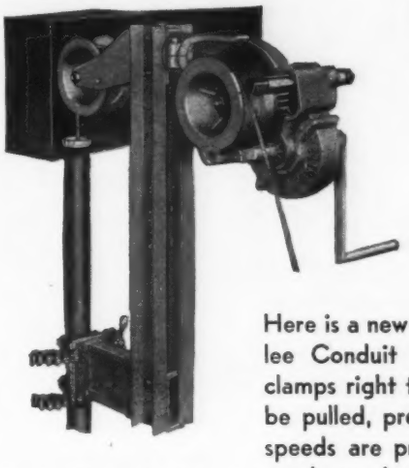
Fig. 5—Wound core distribution transformer

1.5 kva., 60 cycle, 2,400/4,160 Y to 120/240 volts ready for installing clamps.

and unstrained, unstressed condition; that is, with the outer turn as outer turn, the inner as inner (Fig. 4). At a demonstration given by the inventor the heat-treated magnetic roll of the desired finished size and the winding were placed adjacent to each other on a special machine. The outer turn of the magnetic roll was passed through the winding and brought back and tack welded to the roll. The machine was then started, and within a couple of minutes the winding was completely linked by the roll in its original heat-treated condition; that is, in the same size, shape and sequence of turns, with the outer turn as outer turn, the inner as inner, and with no residual stress or strain. The operation was repeated on the other leg of the winding and the transformer was completed—an *all-wound* transformer (Fig. 5).

Description of the winding machine and detailed data on the transformer

Put Efficiency in Your **CABLE PULLING** *With the Greenlee*



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CONVENIENT

Here is a new cable puller that is in a class with Greenlee Conduit Benders as a labor-saving device. It clamps right to the conduit through which cable is to be pulled, preventing the loosening of hangers. Two speeds are provided, and it is arranged so that two cranks can be used. Can also be driven by a portable power unit.

The illustration here shows this new tool set up for pulling into a box from a vertical section of conduit. In order to make it possible to use it in any position, the tension drum can be swiveled through a complete circle. This drum is quickly removable for easier portability, and it is arranged so it can be bolted to a plank for use as an ordinary winch.

Write for complete information on this convenient cable puller. Also if you don't have a copy of our new Catalog, No. 31E, ask for one. It describes this tool in addition to Hydraulic Conduit Benders, Pipe Pushers, etc.

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Every man interested in electric power connectors meeting NEMA standards should have this new publication in his reference file. There will be no charge. The book is a gift to the industry.

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51 Muirhead Ave. Trenton, N. J.

have been published elsewhere* and need not be repeated here, but in observing and appraising this latest contribution of research and inventive art one cannot help but recognize it as a revolutionary development offering real opportunity for further material progress, as contrasted with previous evolutionary refinements, in a field in which such opportunities were becoming increasingly rare.

* See "The Wound Core Distribution Transformer," by E. D. Treanor, *Electrical Engineering*, November, 1938.

The Income Tax Return Mystery

[*Continued from page 54*]

Commonwealth & Southern, suggested to the committee that the SEC would be a satisfactory arbitrator as to the price to be paid his company for its electric properties, to end the impasse in the present negotiations.

That, opined Mr. Biddle very flatly, would not be constitutional!

The rather well-esteemed legal firm of Winthrop, Stimson, Putnam & Roberts presented a legal opinion to the contrary, which, to most lawyers in Mr. Biddle's place, would be rather embarrassing, especially as they quote the President's argument to Congress for the setting up of "a Tennessee Valley Authority—a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise."

•

NEMA Commended for Planned Trade Program

National Electrical Manufacturers Association is cited as an outstanding example of successful trade association experience in "Today's Challenge to Trade Associations," just published by the western division of the Chamber of Commerce of the United States. This is a series of lectures delivered before the Western Conference for Commercial and Trade Executives, held last August at Stanford University, by Roscoe C. Edlund.

"Nobody," says Mr. Edlund, "has done a more complete job of mapping out a detailed program than the National Electrical Manufacturers Association." Commenting on the wide scope of the services performed by this organization, he expresses special admiration for its industrial relations program.

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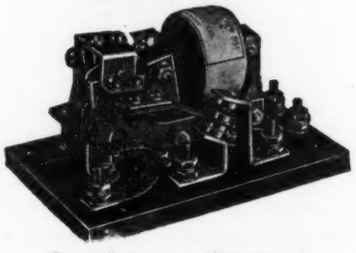

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FAIRFIELD, IOWA
Nut Housing locks EVERSTICK firmly on rod.
POWER TO HOLD

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ONE OF THE MANY BURNDY CONNECTORS
SERVITS

Street-Lighting Business For Small Cities

[*Continued from page 40*]

they are engineers, but their strength is their understanding of municipal management. They know municipal problems and how to talk the language of the city father. This knowledge is most helpful in maintaining proper relationships with the right people and keeping in time with the ever-changing multitude of municipal officials. However, we recognize the municipal authorities as the buyers—and treat them as such.

When new jobs are sold they are given wide publicity within the company's area. The public acknowledges its gratitude to its alert officials and municipal authorities and the public from future prospect towns are brought in and exposed to the comforts and delights of modern adequate street lighting.

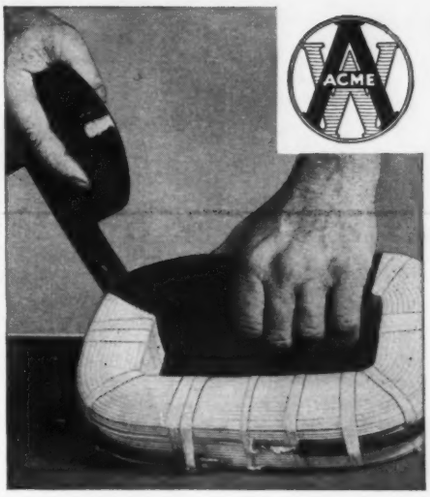
As for results, one of the latest jobs will serve as an illustration. We refer to the city of Greensburg, Pa., population 16,508, for which a planned program was made and whose authorities were so pleased and enthusiastic that the entire plan was adopted for execution as a unit. The original total candle-power equaled 231,250 and the new candle-power is 384,250. However, the substitution of the modern pendant luminaire for the old upright units on all inclosed fixtures has at least doubled the effective street illumination. Greensburg is highly pleased. Any sale in which the customer more than doubles his advantage at a 50 per cent increase in cost and the company places itself in a position to render a more perfect service at some increase in profit is a good sale. The sale of street lighting is good business, and we are going after it. The curve has turned up.

Trend of Street-Lighting Unit Sizes in West Penn Territory

	Number of Units Installed	
Candlepower	1929	1938
100	7,114	3,461
250	5,116	9,739
400	1,054	0
600	1,404	0
500	0	3,803
1,000	304	165
1,500	94	6
2,500	8	8
Total candlepower	3,719,400	4,876,350

Size of Communities

20,000 to 25,000 population	4
5,000 to 20,000 population	20
1,000 to 5,000 population	134



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PLENTY OF STRETCH!

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The Acme Wire Co., New Haven, Conn.

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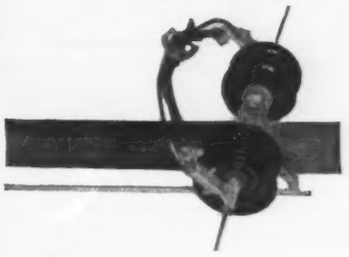
K-P-F

Pole Top High Tension Switches



A K-P-F switch merely consists of two deadends with a rigid jumper containing a contact so arranged that it can be opened and closed. This constitutes the NECESSARY and SUFFICIENT parts of a disconnecting switch.

K-P-F ELECTRIC CO.
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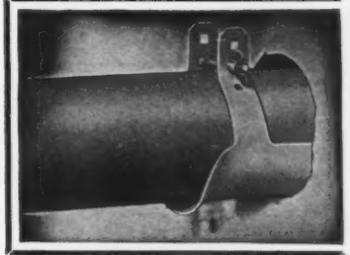

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Resin Protects Cable Against Oil Migration

[*Continued from page 49*]

The holder used in such installations is a synthetic rubber glove, three fingers of which slip over the conductors and the wrist of the glove is tied over the lead sheath. Varnished cambric taping with hot "Vinsol" compound brushed between the layers of tape is applied over the conductor insulation. After the fingers of the glove are placed in final position, a second layer of taping with "Vinsol" compound is applied over the fingers and the previously applied taping from the body of the glove to the cable lug. The glove is filled with the compound and is taped over with varnished cambric tape with the compound applied between the layers of tape.

Since part of the cable entering the transformer is in a vertical position and some oil migration of cable-impregnating compound may occur and may dissolve an asphaltic base compound, the first joint next to the transformer is also filled with the "Vinsol" compound. This also serves as a secondary line of defense against transformer oil migration. The compound used in these installations consists of 70 per cent "Vinsol" resin manufactured by the Hercules Powder Company and 30 per cent commercial grade castor oil. At the Detroit Edison Company we do our own mixing of the compound.

Extensively applied

On the Detroit Edison System approximately 80 cable ends trained into the terminal box of transformers have been recently replaced and equipped with "Vinsol" oil stops.

Characteristics of the "Vinsol" compound are:

1. The compound is practically insoluble in mineral oils such as are used in transformers or cables, or other electrical installations.
2. When the compound is mixed with transformer oil there is practically no increase in the power factor of the mixture over that of the transformer oil alone, between temperatures of 20 deg. C. and 80 deg. C.
3. Dielectric strength test of the transformer oil alone is 33.8 kv.; transformer oil and 0.5 per cent "Vinsol" compound mixture 34.9 kv.; "Vinsol" compound alone 92 kv. These values were found at room temperature.
4. Average coefficient of expansion of the compound was found to be 0.00035 per degree F.
5. The compound softens at around 70 deg. C., but does not flow at this temperature. This softening point can be varied to meet climatic conditions by varying the proportions of "Vinsol" resin and castor oil.

In conclusion, it is felt that this new type filling compound has all the advantages of the old joint-filling compounds plus the added advantage of oil insolubility. Wherever there is a danger from oil migration it is felt that this compound will be of great value. We also feel that even where there is no danger of oil migration the "Vinsol" compound will fill up the space within a joint or a terminal better than the petroleum base-filling compounds because of the smaller amount of volatile gases in the "Vinsol." With the above facts in mind, and since this joint-filling compound is not affected by the cable-impregnating compound it is possible that the hand-applied insulation in low-voltage joints may be reduced or entirely eliminated.

•

Permits Property Transfer

Ohio Public Utilities Commission recently approved a trade of properties by the Ohio Public Service Company and the Toledo Edison Company, designed to integrate the two Cities Service affiliated power companies. Ohio Public Service will transfer to Toledo Edison all its property in Wood, Seneca, Lucas and part of Sandusky County, receiving in return the Toledo Edison's transmission lines from Lorain to Fremont via Sandusky and from Ceylon Junction to Fremont.

•

Permits Pacific Stock Deal

Demise of San Joaquin Light & Power Corporation, subsidiary of the Pacific Gas & Electric Company, was approved by the California Railroad Commission when it recently authorized P. G. & E. to acquire the remaining outstanding preferred stock of the corporation. The authorization followed a recent request for the move by Pacific Gas. No change in organization or operation of the San Joaquin system is contemplated.

•

Ohio Stock Exchange Ready

Holders of the Ohio Electric Power Company 7 per cent and 6 per cent preferred stocks are being advised that they may now exchange their securities for preferred stock in the Marion Reserve Power Company, under the provisions of a recently consummated merger on the following basis: For each share of Ohio Electric 7 per cent preferred, 1 1/3 shares of Marion Reserve $5 preferred, and for each share of Ohio Electric 6 per cent preferred, 1¼ shares of Marion Reserve $5 preferred.

•

Approves Power Plant

At a conference between Premier Duplessis and members of the Province's Electricity Syndicate, it was decided to establish the Quebec Government's projected 26,000 hp. electric plant on the Upper Ottawa.

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OFFICIAL PROPOSAL

Bids: December 13 (50)

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AND ACCESSORIES
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P.W.A. PROJECT DOCKET NO. TENN. 1105-P-DS
ELECTRIC DISTRIBUTION SYSTEM
SUB-PROJECT—CONTRACT NO. 3-G
ELECTRIC POWER BOARD OF CHATTANOOGA
CHATTANOOGA, TENNESSEE

Sealed proposals for the manufacture and delivery of Sub-Project—Contract No. 3-G of the Electric Power Board of Chattanooga, acting for and on behalf of the City of Chattanooga, Chattanooga, Tennessee,

P.W.A. Project Docket No. Tenn. 1105-P-DS
Electric Distribution System

SUB-PROJECT—CONTRACT No. 3-G will be received by the Electric Power Board of Chattanooga, Chattanooga, Tennessee, at the office of the Secretary of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee, until 1:30 P. M. on the thirteenth day of December, and will be immediately publicly opened and read by the Electric Power Board of Chattanooga.

Copies of the Proposal, Contract Documents and Specifications may be obtained from the office of the Electric Power Board of Chattanooga, Municipal Building, Chattanooga, Tennessee. A deposit (certified check) of twenty-five ($25) dollars will be required for procuring the Proposal, Contract Documents and Specifications. The deposit for these documents will be returned to all except the successful bidder upon the return of the documents in good condition within ten (10) days after the bids are opened.

A copy of the Proposal, Contract Documents and Specifications may be examined free of charge at the Chamber of Commerce and the office of the Electric Power Board of Chattanooga, Chattanooga, Tennessee.

Each bid must be accompanied by a Certified **Check, or Bidder's Bond** executed by the bidder and a surety company licensed **to do business in Tennessee**, in the sum of ten (10%) per cent of the amount of the bid. The bond is required as a guarantee that if the bid is accepted, a contract will be immediately entered into and the performance of it properly secured. **The successful bidder** will be required to execute a Performance Bond in the amount of one hundred (100%) per cent of the contract price. This Performance Bond shall be made through a Company having a duly authorized representative in Chattanooga, Tennessee, upon whom process may be served.

All items in the proposal form and on data sheets must be properly filled out and must not be detached from the specifications. No qualifying letters or statements will be considered.

Bidder's name must be placed on the envelope containing this document and also upon this envelope shall be designated the name and contract number which the bid covers.

WITHDRAWAL OF BIDS: Bidders may withdraw **bids at any** time prior to the opening, but thereafter no bidder may withdraw a bid submitted for a period of sixty days after the date set for the opening of such bids.

The estimated cost of the equipment of the Project covered by this contract is $95,000.

The Electric Power Board of Chattanooga, Chattanooga, Tennessee, reserves the right to reject any and all bids, and to waive informalities therein.

Any bid received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

ELECTRIC POWER BOARD OF CHATTANOOGA
Chattanooga, Tennessee
By L. J. WILHOITE, Chairman
J. C. TWINAM
G. H. PATTEN
STANTON E. SMITH

Will F. Chamlee, Counsel.
Attest:
N. J. Simmons, Secretary.